

INTRODUCTION AND OVERVIEW

The introductory summary cover letter to this NRA notes that starting with this ROSS-2000 NRA the Office of Space Science (OSS) is beginning to reorganize its research programs into a series of Clusters to allow the eventual consideration of the reallocation of resources in compliance with evolving NASA program priorities and strategy. This Introduction and Overview to Appendix A provides a guide to the contents of this Appendix and the relationship of the Clusters and their program components to the OSS science themes.

I. Sun-Earth Connection

The Sun-Earth Connection (SEC) science theme of NASA's Office of Space Science (OSS) supports investigations of the Sun and planetary space environments, including the origin, evolution, and interactions of space plasmas and electromagnetic fields in the heliosphere and in connection with the galaxy. Understanding the origin and nature of solar activity and its effect on the space environment of the Earth is a particular focus. Current discipline interests are:

Heliospheric Physics: the origin and behavior of the solar wind, energetic particles, and magnetic fields in the heliosphere and their interaction with the interstellar medium;

Solar Physics: the Sun as a typical dwarf star, and as the dominant, time-varying source of energy, plasma, and energetic particles in the solar system, especially concerning its influence on the Earth;

Magnetospheric Physics: the physics of magnetospheres, including their formation and fundamental interactions with plasmas, fields, and particles; the Earth's magnetosphere is emphasized, but studies of the magnetospheres of planets, comets, and other primordial bodies are also supported; and

Ionospheric, Thermospheric, Mesospheric (ITM) Physics: the physics of the mesosphere, thermosphere, ionosphere, and aurorae of the Earth, including the coupling of these phenomena to the lower atmosphere and magnetosphere.

The strategic vision for the Sun-Earth Connection is embodied in the Sun-Earth Connection Roadmap - Strategic Planning for the Years 2000-2025 available on line at <http://www.lmsal.com/sec/>. Sun-Earth Connection research program supports several types of endeavors, including Supporting Research and Technology (SR&T) and Low Cost Access to Space (LCAS) programs in the various disciplines, the Sun-Earth Connection Theory Program, as well as Guest Investigator programs. Generic program descriptions follow immediately below, while discipline specific information can be found in the individual SEC program elements.

(1) Supporting Research and Technology (SR&T) Programs support individual research tasks each that employ a variety of research techniques, e.g., theory, numerical simulation, and modeling; analysis and interpretation of space data; development of new instrument concepts; and laboratory measurements of relevant atomic and plasma parameters, all to the extent they have a clear application to Sun-Earth Connection program goals. The solar and heliospheric SR&T programs are administered as part of the Solar and Heliospheric Physics cluster, which is described in Appendix A.2, while the magnetospheric and ITM SR&T programs are included in the Geospace Cluster described in Appendix A.3

(2) Low Cost Access to Space (LCAS) Programs have as their objectives: (i) allowing investigation that require the space-flight of instrumentation, and (ii) proof-testing new concepts in experimental techniques that may ultimately find application in Sun-Earth Connection missions. The LCAS program for Solar Physics is treated in the Solar and Heliospheric Physics cluster and the combined LCAS program for Magnetospheric and ITM physics is treated in the Geospace Cluster.

(3) Sun-Earth Connection Theory Program (SECTP). This program supports efforts to attack problems concerning phenomena relating to the Sun-Earth Connection program that are beyond the scope of the nominally smaller SR&T tasks discussed above using relatively large "critical mass" groups of investigators. Funding for SECTP is competed in its entirety every three years. A SECTP competition was advertised through the ROSS-98 NRA, and the next opportunity to propose is not anticipated until ROSS-2001; see Appendix A.1.1.

(4) Guest Investigator (GI) Programs. Guest Investigator Programs are intended to maximize the return from currently ongoing missions by providing support for research which heavily utilizes mission specific data from currently operating spacecraft. Current Sun-Earth Connection GI programs are summarized in Appendix A.1.2

Proposals to any of the SEC program elements are expected to present, within their Scientific/Technical/Management Section (see Section C.5.3 of Appendix C):

- a clear description of a specific scientific problem;
- a description of how the attack on this problem will be carried out; and
- a discussion of the relevance of the proposed research to NASA's current and/or future programs.

Proposals for instrument and/or technique development are welcome, but must demonstrate that the proposed development is important to the solution of some important science question.

II. Solar System Sciences

The Origin and Evolution of Solar System Bodies Cluster A.4 includes the following programs: Cosmochemistry, Planetary Geology and Geophysics, Origins of Solar Systems, Mars Data Analysis, and Lunar Data Analysis. This Cluster relates primarily to the Solar System Exploration science theme, though one of its components also relates strongly to the Astronomical Search for Origins theme as well.

(1) The Cosmochemistry Program (Appendix A.4.1) supports scientific investigations that are cosmochemical in nature and may involve laboratory studies of a variety of extraterrestrial materials (meteorites, cosmic dust, and lunar samples) or understanding of the geochemical nature of the solar system bodies.

(2) The Planetary Geology and Geophysics (Appendix A.4.2) program supports scientific investigations of the planetary surfaces and interiors, satellites (including the Moon), satellite and ring systems, and smaller solar system bodies such as asteroids and comets.

(3) The Origins of Solar Systems Program (Appendix A.4.3) solicits basic research proposals to conduct scientific investigations related to understanding the formation and early evolution of planetary systems and to provide the fundamental research and analysis necessary to detect and characterize other planetary systems.

(4) The objective of the Mars Data Analysis Program (Appendix A.4.4) is to enhance the scientific return from the Mars Pathfinder (MPF) and Mars Global Surveyor (MGS).

(5) The objective of the Lunar Data Analysis Program (Appendix A.4.5) is to enhance the scientific return from the Lunar Prospector Mission (LPM) by broadening the scientific participation in the analysis of the LPM data.

The Planetary Systems Science Cluster A.5 is an element of the Solar System Exploration (ESS) science theme of NASA's Office of Space Science (OSS). This cluster supports investigations of all classes of objects in the Solar System except the Earth and Sun, consistent with the strategy for Solar System Exploration embodied in Mission to the Solar System: Exploration and Discovery, A Mission and Technology Roadmap (available at <http://sse.jpl.nasa.gov/roadmap/>). The programs within this section are described briefly as follows:

(1) Planetary Astronomy (Appendix A.5.1) supports ground-based telescopic observations that contribute to understanding the general properties and evolution of planets, natural satellites, asteroids, and comets.

(2) Near Earth Object Observations (Appendix A.5.2) supports ground-based telescopic observations to inventory the population of near Earth Objects and to characterize a representative sample of them.

(3) Planetary Atmospheres (Appendix A.5.3) supports investigations directed at the understanding of atmospheres, including their formation, evolution, and fundamental properties.

(4) Planetary Suborbital Research (Appendix A.5.4) provides support for the remote sensing of solar system objects from sounding rockets, stratospheric balloons, Shuttle-based platforms, or the Space Station. Proposals for fabrication of flight instruments are appropriate only in the suborbital program.

Proposals to any of these programs must present, within their Scientific/Technical/Management Sections (see Section C.5.3 of Appendix C):

- a clear description of a specific scientific problem;
- a description of how the attack on this problem will be carried out; and
- a discussion of the relevance of the proposed research to NASA's current and/or future programs.

Proposals whose intent or purpose is to extend or directly supplement investigations selected for approved space flight missions are not appropriate for this NRA. Investigators who are members of the science teams of ongoing missions and who propose to use data from these missions in their SR&T efforts must clearly delineate between their mission responsibilities and the proposed efforts.

III. Astrobiology and Planetary Instrumentation

The Astrobiology and Planetary Instrumentation Cluster (Appendix A.6) includes Exobiology research, as well as the Planetary Instrument Definition and Development and the Planetary Major Equipment. This Cluster relates to both OSS science themes Astronomical Search for Origins and Solar System Exploration.

(1) The Exobiology Program (Appendix A.6.1) seeks to understand the origin, evolution, and distribution of life in the universe. Research is centered around the origin of life and is focused on achieving this goal by tracing the pathways taken by the biogenic elements, leading from the origin of the universe through the major epochs in the evolution of living systems and their precursors. In addition, research in the area of planetary protection and exobiology instrument concepts may also be supported.

(2) The Planetary Instrument Definition and Development Program (Appendix A.6.2) supports the advancement of spacecraft-based instrument technology that shows promise for use in scientific investigations on future planetary missions. The goal of the program is not to develop flight-qualified hardware but rather to define and develop scientific instruments or components of such instruments to the point where the instruments may be proposed in response to future announcements of flight opportunity without additional extensive technology development.

(3) The Planetary Major Equipment (Appendix A.6.3) program allows proposals for upgrading the analytical, computational, telescopic, and other instrumentation required by investigations sponsored by the Solar System Exploration programs, including Exobiology.

IV. Space Astrophysics

The Space Astrophysics Research and Analysis (SARA) program as described in Appendix A7.1 of this solicitation is a consolidation of the programs previously known as Space Astrophysics Suborbital, the Space Astrophysics Detector Development, and the Space Astrophysics Research and Analysis, which were separate elements of NRA 99-OSS-01 (ROSS-99). This Cluster relates strongly to both the Astronomical Search for Origins and the Structure and Evolution of the Universe OSS science themes. It now contains all research elements of both the Ultraviolet, Visible, and Gravitational Astrophysics program and the Infrared, Submillimeter, Radio, and Interferometry Astronomy program, as well as the laboratory astrophysics component of the High Energy Astrophysics program. The primary goal of the SARA program is to obtain a better understanding of astrophysical objects and phenomena as revealed through their electromagnetic radiation characteristics in the wavelength regime greater than approximately 100 Å through the radio spectrum, and studies in relativity, gravitational astrophysics and tests of the fundamental laws of physics as relevant to astrophysics, and cosmology.

NASA intends to solicit proposals for the consolidated SARA program every year. An annual solicitation will provide more frequent opportunities to investigators for proposing new ideas. However, since the evolution to an annual solicitation is within the previously available budgets for these programs, the budget wedge available for funding new programs through this solicitation is very limited. The wedge is expected to grow only as the phasing of the component programs change and the funding cycle reaches a steady state.

V. High Energy Astrophysics

The High Energy Cluster represents the consolidation of the High Energy Astrophysics (HEA) (now called X-Ray and Gamma-Ray Astrophysics [A.8.1]) and Cosmic Ray Physics (CRP) (now called Cosmic Ray Astrophysics [A.8.2]) Program Elements as defined in the ROSS-99 NRA. This new program element solicits basic research proposals to conduct investigations that are relevant to the NASA X-Ray and Gamma-Ray (XGA) and Cosmic Ray Astrophysics (CRA) Supporting Research and Technology (SR&T) Programs. The primary goal of the XGA and CRA programs is to obtain a better understanding of astrophysical objects (excluding the Sun) and phenomena as revealed through their high-energy radiation characteristics and to conduct studies of the origin, acceleration, and transport of galactic cosmic rays. This Cluster will be jointly managed by the Discipline Scientists responsible for the above programs.

In prior Announcements, proposals for participation in the HEA (XGA) and CRP (CRA) SR&T Programs were solicited and reviewed on a three-year cycle. Starting with this NRA (for investigations commencing in Fiscal Year (FY) 2001), the solicitation and review of proposals for participation in the above programs will be conducted jointly. In addition, a transition to an annual solicitation/review cycle will begin, with the goal of reaching a steady-state situation by FY 2003 in which approximately one third of the total Cluster funds will be made available annually. In the case of the HEA (XGA) SR&T Program, which underwent its three-year review in response to the ROSS-99 NRA, this transition to annual reviews was begun by selection of a mix of one-, two-, and three-year projects in response to that NRA. For the CRP (CRA) SR&T Program, which underwent its three-year review two years earlier in response to the ROSS-98 NRA, this transition has required that some of the ongoing grants be terminated one year early, i.e., nominally after two years instead of three. The impacted grantees have been notified of their need to respond to this NRA.

VI. Interdisciplinary Program Elements

For purposes of this ROSS-2000 NRA, the only component of this Cluster (Appendix A.9) is the Applied Information Systems Research (AISR) program, which supports information systems research to apply new developments in computer science and information technology to improve and enhance ongoing support for any of the OSS science programs. The specific goals of the AISR program are to:

- Increase the scientific return on research within all OSS science themes by making advanced tools and capabilities available for the acquisition and utilization of science data and information;
- Exploit advances in computer science and information technology for the benefit of space science; and
- Promote strong collaborations involving the space science community, computer science community, data system engineers and technologists, academia, and the private sector and technology innovators.

A.1.1 Sun-Earth Connection Theory Program (SECTP)

1. Scope of Program

The scientific purview of the SECTP encompasses solar physics, heliospheric physics, magnetospheric physics, and ionospheric, thermospheric, and mesospheric physics. The SECTP supports theory and modeling investigations of the highest scientific quality dealing with problems of fundamental importance within or transcending the boundaries of these individual disciplines. The key characteristics of successful SECTP investigations are that they are of the highest intrinsic scientific quality, and that they also propose to attack problems falling within the Sun-Earth Connection science theme of sufficient breadth that their successful completion requires the efforts of a synergistically interacting group of investigators. Proposals that serve only as an umbrella for a variety of separate research tasks, even though the tasks are related by a common theme, are not appropriate for the SECTP. Proposals for narrowly focused and/or smaller scope theoretical efforts should be submitted to the individual SEC science discipline program elements described in this appendix. An important characteristic of the SECTP is that it encourages the exploration and development of new areas in the Sun-Earth Connection theme, especially interdisciplinary ones, and, in so doing, may develop objectives for future but as yet undefined space missions.

2. Programmatic Information

Selections for the SECTP are nominally for a three-year period of performance with annual funding allotments contingent upon the submission of satisfactory progress reports and available funding. The most recent SECTP selections were carried out under the auspices of the ROSS-98 NRA, and funding for the selected investigations started in Fiscal Year 1999. The total budget for this program element is about \$3.5 M. The next selection opportunity is expected to be advertised in ROSS-2001. Therefore, proposals for this program element are not solicited through this current ROSS-2000.

Questions concerning this program may be addressed to the Discipline Scientist:

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Code SR

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A.1.2 Sun-Earth Connection Guest Investigator Program

1. Scope of Program

A multiple year Sun-Earth Connection (SEC) Guest Investigator Program (GIP) is offered for investigations that extensively draw upon the data sets from the SEC missions operating during the current solar maximum. The solar maximum objectives include solving the more complex and varying problems associated with this period of increased activity. SEC Guest Investigator Programs are intended to maximize the return from currently operating missions by providing support for research of breadth and complexity beyond that of presently funded investigations. The proposed investigations should be constructed to employ expertise for interpreting data from multiple spacecraft and other related sources, and to carry out the associated interpretative data analysis, theory, and modeling. While global system problems utilizing as much of the SEC mission data as appropriate are of special interest, problems of all scales within the SEC realm may be addressed by the solicited investigations.

The objectives of this SEC GIP are:

- 1) to understand the solar interior and the solar atmosphere, including the evolution of mass and energy ejected from the solar atmosphere;
- 2) to understand the propagation of disturbances in the three-dimensional as well as the distant heliosphere; and
- 3) to investigate the flow of mass, energy and momentum throughout the near space environment of the Earth.
- 4) to investigate the effects of solar activity on the Earth's atmosphere and ionosphere.

Proposers interested in submitting in response to this program element should also read Section I of the INTRODUCTION AND OVERVIEW to this Appendix for an overview of The Sun-Earth Connection (SEC) science theme the NASA Office of Space Science.

Specific information on the SEC missions, key personnel and data sets is found via the [SEC homepage \(http://sec.gsfc.nasa.gov/sec_missions.htm\)](http://sec.gsfc.nasa.gov/sec_missions.htm). Prospective guest investigators are strongly encouraged to contact the PI team **or teams** to which they wish to be attached in an early stage of their proposal preparation in order to achieve early clarification of the following two critical questions:

- 1) Is the proposed investigation in direct conflict with that of the PI teams, either through duplication of declared major PI team objectives, or interference with planned observations? Note that in this regard, PI teams may recommend to prospective GI's that they consider different SEC instrument teams if this seems more appropriate.
- 2) If appropriate, are the proposed observations feasible using currently operating instruments, and, if so, can they be carried out with a reasonable amount of effort and time?

2. Information on Specific SEC Mission Data Sets

This section describes specific terms and conditions relating to proposed SEC GIP investigations on employing data from the individual SEC missions. Data from the following missions, IMAGE, Cluster II, and TIMED, are not to be considered in this solicitation. These missions will be included in future SEC GIP solicitations. However, data from HESSI may be employed in the proposed investigations (see below).

A. Geospace Missions

Incorporated into this SEC GIP is correlative scientific research--data analysis, theory, and simulations--that heavily utilize the databases from Geotail, Wind, Polar, and the associated ground-based and theory investigations. Additional databases are those of IMP-8, SAMPEX, FAST, ACE, Equator-S, and SNOE data. The analysis of relatively new mission data may be limited to “quick-look” products accessible on the World Wide Web (or other, appropriate and openly available data).

Questions concerning the Geospace missions should be addressed to:

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B. Heliospheric Missions

The missions contributing to our knowledge of the heliosphere include IMP-8, Voyager, Ulysses, SAMPEX, and ACE. Proposals combining data from these Heliospheric missions with other data from active and past SEC missions are especially pertinent. Questions concerning these Heliospheric Missions should be addressed to either:

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C. Solar Missions

The set of solar missions includes Yohkoh, SOHO, TRACE and HESSI.

- High Energy Solar Spectroscopic Imager (HESSI). The launch of HESSI is anticipated in the summer of 2000. Proposals that will employ data from the HESSI database (all data from HESSI, regardless of age) are invited to the SEC GIP. [Information on HESSI](#) is available on line at <http://soleil.ssl.berkeley.edu>. Attention is also directed to Section A.2.1 of this Appendix wherein HESSI Project funds are offered for investigations focussing on HESSI data analyses.

- Solar and Heliospheric Observatory (SOHO): SOHO is a mission of international cooperation between ESA and NASA. Proposals are invited as part of the SEC GIP requiring new SOHO observations, analysis of existing data, theoretical analysis in relation to SOHO observations, or ancillary ground-based observations. Two types of Guest Investigator participation in the SOHO mission are foreseen.

For the coronal experiments, GI's will be attached to an experiment team, and within that team have priority rights for the analysis of certain data sets or priority rights for a certain type of analysis. This mode of participation will apply to data from the following investigations: Coronal Diagnostic Spectrometer (CDS), Extreme-ultraviolet Imaging Telescope (EIT), White Light and Spectrometric Coronagraph (LASCO), Solar Ultraviolet Emitted Radiation (SUMER), Solar Wind Anisotropies (SWAN), and Ultraviolet Coronagraph Spectrometer (UVCS).

The data for the particle and helioseismology experiments do not lend themselves to being split up into 'events,' observing sequences, or time intervals, and, therefore, approved GI's will be included as members of the PI teams and share the rights and obligations of the team members. This mode of participation will apply to data from the following investigations: Charge, Element, and Isotope Analysis (CELIAS), Suprathermal and Energetic Particle analyzer (COSTEP), Energetic Particle Analyzer (ERNE), Global Oscillations at Low Frequencies (GOLF), Variability of Solar Irradiance (VIRGO), and the Michelson Doppler Imager/Solar Oscillations Imager (MDI/SOI).

The recommendations for selection of GI proposals addressing SOHO will be made by the SOHO Guest Investigator Selection Committee (GISC) whose members are appointed by ESA and NASA. The mission PI teams will be asked for their comments on relevant proposals. Proposals will be evaluated according to their overall scientific merit, relevance to the SOHO mission, compatibility with declared SOHO PI team objectives, and feasibility. It is necessary but not sufficient for approval for a GI proposal addressing SOHO that the proposed work add to the expertise existing within the SOHO experiment team rather than simply duplicating it. Proposals combining data from SOHO with other SEC mission data are especially pertinent. GI's proposing from non-U.S. institutions are expected to obtain funding for their research from their national institution (see Section C.4 in Appendix C). Interested parties may consult the December 1995 issue of *Solar Physics*, or may see the detailed [SOHO information](http://sohowww.nascom.nasa.gov) found at the World Wide Web site <http://sohowww.nascom.nasa.gov>

- Transition Region and Coronal Explorer (TRACE). Proposals are invited as part of the SEC GIP for TRACE scientific research--data analysis and theory--that heavily utilize the publicly open database (all data from TRACE, regardless of age). [Information on TRACE](#) may be found on line at <http://vestige.lmsal.com/TRACE/> .

- Yohkoh. Proposals are invited as part of the SEC GIP for Yohkoh scientific research--data analysis and theory--that heavily utilize the publicly open database (data older than one year). See http://umbra.nascom.nasa.gov/yohkoh/data_availability.html

Note that the Instrument PIs on SOHO, the U.S. PI for Yohkoh, and the mission PIs for TRACE and HESSI may not receive funding from nor propose as a PI to this Guest Investigator Program.

Questions concerning the Solar Physics missions should be addressed to the Discipline Scientist:

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3. Programmatic Information

Proposals whose intent or purpose is to extend or directly supplement existing investigations already funded for approved space flight missions or SR&T programs are not appropriate for this SEC GIP. Investigators who are members of the science teams of ongoing missions and who propose to use data from those missions must clearly demonstrate that the research proposed is distinct from the existing efforts. A PI or Co-I on a qualifying SEC mission may also propose as a PI or Co-I to this SEC GIP. (See the exception to this in section A.1.2.2.B above.) However, such SEC mission personnel must include in their proposal a description of their mission responsibilities, which are not to duplicate the research proposed for the SEC GIP.

We expect that approximately \$2.5M will be available for the first year of this solicitation and that the proposed investigations will be for one to three year awards at a funding level of about \$75K per year. For multiple year awards, funding approval for the subsequent year(s) will be based upon the tangible scientific achievements of the first year and the continued program need and funds thereafter.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the Cover Page/Proposal Summary (see Appendix C.5) is TBD*. Note that the NOI, as well as the Cover Page, will request an indication of the mission or missions whose data are called for in the proposed investigation. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Sun-Earth Connection Guest Investigator Program
TBD*

* TBD: see SPECIAL NOTE (3) on p. 6 of the summary cover letter of this NRA.

A.1.3 Astrophysics Data Program (ADP)

1. Scope of Program

This NRA solicits proposals for (A) research involving the NASA space astrophysics data sets currently archived and in the public domain, (B) the analysis of new observations obtained by the ASCA, RXTE, BeppoSAX, CGRO or EUVE satellites and awarded through competitive peer review and (C) observing time with WIRE. The period of performance for solicited proposals may be from one to three years. Proposals for data reduction and analysis of new observations (only) should have a duration of one year, whereas proposals that also include relevant public-domain archival data analysis may request periods of performance for up to three years. Abstracts of currently funded Astrophysics Data projects can be found on line at <http://spacescience.nasa.gov/research.htm>.

- *Type A: Archival Proposals*

This Announcement solicits *Type A* proposals for research in astrophysics whose dominant emphasis is the analysis and interpretation of public-domain, archival data most of which have undergone considerable calibrations, ordering, and refinements, and for which extensive data analysis software tools exist from the following list of space astrophysics missions:

- 2MASS (considered ground-based data)
- Advanced Satellite for Cosmology and Astrophysics (ASCA)
- Astro Shuttle Experiments [Hopkins Ultraviolet Telescope (HUT), Wisconsin Ultraviolet Photopolarimetry Experiment (WUPPE), Ultraviolet Imaging Telescope (UIT), and Broad-Band X-Ray Telescope (BBXRT)]
- Beppo Satellite di Astronomia X (SAX)
- Compton Gamma-Ray Observatory (CGRO)
- Cosmic Background Explorer (COBE)
- European X-Ray Astronomy Satellite (EXOSAT)
- Extreme Ultraviolet Explorer (EUVE)
- Ginga
- High Energy Astronomy Observatories (HEAO-1, 2, and 3)
- Infrared Astronomical Satellite (IRAS)
- Infrared Space Observatory (ISO)
- International Ultraviolet Explorer (IUE)
- Lunar Laser Ranging (LLR)
- ORFEUS-SPAS I
- Roentgen Satellite (ROSAT)
- Rossi X-ray Timing Explorer (RXTE)
- Voyager Ultraviolet Spectrometer (UVS).

Note that public domain archival data from the preceding and other space astrophysics missions are included in this NRA, but that proposals for archival research using data from the Hubble Space Telescope (HST) and the Chandra X-Ray Observatory (CXO) are solicited through separate announcements.

2MASS data is considered ground-based, and as such can only constitute up to 10% of the proposed research.

- *Type B: Awarded Time Observing Proposals*

This ADP proposal solicitation includes a *Type B* category for proposers who have already been awarded observing time on current observing cycles RXTE (Cycle 5), ASCA (Cycle 8), BeppoSAX (Cycle 4), CGRO (Cycle 10) or EUVE (Episode 8) and seek funding support for data reduction and analysis of the resulting observations. In the case of CGRO, this pertains only to observations with the three pointed instruments (OSSE, COMPTEL and EGRET). Type B Proposals may supplement the primary RXTE/ASCA/SAX/CGRO data reduction and analysis of new observations with data analysis of relevant public-domain, archival data from these and other space astrophysics missions. Although type B Proposals may contain either the text originally submitted to RXTE/ASCA/SAX/CGRO for observing time, or merged/revised text, the text submitted should not be that of an observing proposal. Note that Type A, Type B, and Type C proposals will compete together in the same science panels.

RXTE or CGRO Targets Of Opportunity (TOO): Type B proposals may be submitted for support of approved RXTE Cycle 4 or CGRO cycle 10 TOO observations. If selected, funding of such 'conditional awards' will not be initiated until after the TOO observation(s) have been satisfactorily completed. Note that at the time of release of this NRA, CGRO is expected to de-orbit by the end of March 2000. Therefore, funding for CGRO should be requested for only those data actually obtained but not yet in the public domain.

- *Type C: WIRE Observing proposals*

This ADP cycle includes a new category, *Type C*, to allow the proposal of new observations using the Wide Field Infrared Explorer (WIRE) satellite, where a limited amount of observing time will be available. Note that this satellite is primarily used as a testing facility for innovative observing modes to be used on other observatories. Therefore these science observations need to be made on a noninterference basis with ongoing engineering activities as the budget to operate this facility originates from these activities. The available modes of observation and the current capabilities of the observatory will be described at a later date. Please contact the [Discipline Scientist](#).

Requirements

In support of these activities, *but as a secondary emphasis*, the proposed research may include theoretical research or numerical modeling, use of existing data from ground-based or suborbital observations, and/or laboratory astrophysics measurements but only as needed to interpret the observations. In addition, NASA will consider requests for support for new ground-based observations provided that the requests are clearly described, the observations are important to the success of the proposed effort, and their expense (including salary, travel, etc.) constitutes no more than 10 percent of the proposal's total budget. The 2MASS data is considered ground-based data in this regard.

Proposers to this NRA should note that the ADP is not intended to support:

- investigations whose primary emphasis is theoretical research, numerical modeling, laboratory astrophysics measurements, or detector development, since there exist other NASA programs that support these research activities;
- investigations whose primary focus is on solar system objects or on the solar-terrestrial interaction, since other NASA programs support this kind of research;
- proposals primarily for the education and training of students;
- proposals for the organizing and/or hosting of scientific meetings; and
- proposals for the acquisition of substantial computing facilities or resources, beyond nominal workstation or network requests.

Prospective submitters should also be aware that considerable research has already been done using these archival data sets both by the original mission science teams, as well as previously selected participants in the ADP. Therefore, proposals should demonstrate how the proposed research clearly extends the frontier of existing knowledge in a fundamental and important manner rather than merely repeating a type of analysis on heretofore unstudied objects of some class or type. If this proposal is itself based on a previously funded research effort, the proposal should identify that work and clearly summarize all significant results from it.

2. Proposal Type, Data Sets, and Research Area

Each proposal must be identified as to Type A, B, or C by checking the appropriate box on the *Cover Page* (see Section 5.3 in Appendix C). For all Types of proposals, the *Cover Page* also provides for designation of the data sets proposed to be used and also of the Research Area, as defined below, that designates the primary focus of the proposal. The primary use of these Research Areas is to facilitate the assignment of each proposal,

regardless of Type, to the appropriate review panel. Note that each proposal, regardless of Type, must identify one primary Research Area (a secondary Area may be designated, if necessary). In any case, NASA reserves the right to reassign a proposal to a different primary or secondary Research Area. The ten defined Research Areas are:

1. *Solar System including the Sun* (Note: proposals whose primary focus is solar system research using the IRAS Asteroid and Comet Survey or Voyager data should be submitted to other NRA's or program elements in this NRA that are relevant to those objectives) for this program element the solar observations are those of high-energy spectral and temporal studies of solar flares utilizing CGRO data;
2. *Star Formation and Pre-Main Sequence Stars* (star forming clouds, protoplanetary and debris disks, protostars, T Tauri stars);
3. *Main Sequence Stars*;
4. *Post-Main Sequence Stars and Collapsed Objects* (giants, isolated white dwarfs, isolated neutron stars, central stars of planetary nebulae, gamma-ray bursts);
5. *Binary Systems* (cataclysmic variables, x-ray binaries, black hole binaries);
6. *Interstellar Medium and Galactic Structure* (supernova remnants, dark clouds, interstellar dust, H II regions, diffuse galactic emission, planetary nebulae);
7. *Normal Galaxies* (-normal galaxies, interacting galaxies, starburst galaxies, Seyfert galaxies, quasars, radio galaxies);
8. *Active Galaxies and Quasars* (interacting, starburst, Seyfert and radio galaxies, AGN's, quasars);
9. *Large Scale Cosmic Structures* (clusters of galaxies, galaxy environment and evolution, intracluster medium, diffuse x-ray background, cosmology);
10. *Relativity and Gravitational Astrophysics* (tests of the fundamental laws of physics as relevant to astrophysics and cosmology).

3. Programmatic Information

It is anticipated that approximately \$2.5M will be available through this ROSS-00 NRA for the funding of new awards for the Astrophysics Data Program, to fund proposals of a maximum of three years duration. The typical level of support per year is expected to be in the range of \$50K.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

See Table 1 of the cover letter of this NRA for the due dates for both the NOI and for the proposal. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is TBD*. Hard copies of the proposals are to be delivered to:

ROSS-20000 NASA Research Announcement
Astrophysics Data Program (ADP)
TBD*

*TBD: see SPECIAL NOTE (3) on p. 6 of the summary cover letter of this NRA.

For further information, contact the Discipline Scientist:

Dr. Daniel Golombek
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0247
E-mail: daniel.golombek@hq.nasa.gov

A.1.4 Long-Term Space Astrophysics Program (LTSA)

1. Scope of Program

The Long-Term Space Astrophysics (LTSA) Research Program is intended to enhance research in space astrophysics by providing a stable long term source of support, up to a maximum of five years, and to strengthen the U.S. long term research base in space astrophysics. Abstracts of currently funded LTSA projects can be found on line at <http://spacescience.nasa.gov/research.htm> .

This ROSS-2000 NRA solicits proposals for research in astrophysics whose dominant emphasis is the analysis and interpretation of data from past, current, and future space astrophysics missions. In support of that activity, but as a secondary emphasis, the proposed research may include theoretical research, numerical modeling, use of existing data from ground-based or suborbital observations, and laboratory astrophysics measurements. In addition, NASA will consider requests for support for new ground-based observations provided that the requests are clearly described, the observations are important to the success of the proposed effort, and their expense (including salary, travel, etc.) constitutes no more than 10 percent of the proposal's total budget.

The LTSA Research Program is intended to support research in space astrophysics that is substantial and cohesive and whose duration and scope go beyond those of the typical proposal funded by other NASA space astrophysics programs. Conversely, this LTSA Research Program is not intended to support:

- investigations whose primary emphasis is theoretical research, numerical modeling, the use of existing data from ground-based or suborbital observations, laboratory astrophysics measurements or detector development, since there exist other NASA programs that support research with these kinds of emphases;
- investigations whose primary focus is on solar system objects or on the solar-terrestrial interaction, since other NASA programs support this kind of research;
- proposals primarily for the education and training of students (*note that this NRA neither solicits nor shall support research/work by graduate students*);
- proposals for the organizing and/or hosting of scientific meetings; and
- proposals for substantial computing facilities or resources, beyond nominal workstation or networking fees.

NASA recognizes that a proposal for a five-year research program cannot be as specific as a proposal for a small near-term research task. Nevertheless, the proposer must convincingly describe the research program with enough clarity to give peer reviewers a clear understanding and appreciation of the proposed effort, as well as its need for a long term period of performance.

2. Types of Proposals

For the purpose of this ROSS-00 NRA, NASA recognizes LTSA proposals from two different groups of researchers, "Junior Researchers" and "Senior Researchers."

Junior Researchers are researchers who are early in their careers and still establishing themselves, such as postdoctoral fellows (beyond their first postdoctoral fellowship), and tenure-track faculty. Based on recommendations from peer reviewers of prior cycles of the LTSA program, Junior Researchers are defined as those more than two years after having received their Ph.D. and fewer than eight years after the Ph.D (i.e., between May 1992 and May 1998 for LTSA-00). The rationale for the lower threshold is that many programs exist for first postdoctoral fellowships with a duration of at least two years. The rationale for the upper threshold is that most universities with tenure-track positions decide on awarding, or not awarding, tenure by the seventh year after the candidate's Ph.D. This simple criterion of using boundaries for "time after Ph.D." is also necessary because it treats researchers in academia, industry, Government, and other organizations on an equal basis. Note that where a Junior Researcher is prevented from proposing as Principal Investigator because of institutional restrictions, a Principal Investigator may submit the proposal on behalf of a Co-Investigator who serves as the actual "Science Principal Investigator," provided that the latter's name and individual research program are clearly identified in the abstract and list of investigators (see the definition of proposal personnel in Section C.1.3 of Appendix C).

Senior Researchers are proposers who are more experienced, as well as better established, such as tenured faculty at the university level and senior scientists at universities and research laboratories. This distinction between Junior Researchers and Senior Researchers should be clear for most potential proposers. Any questions regarding eligibility for Junior or Senior categories should be directed via E-mail to [the discipline scientist](#) .

Support for Junior Researchers is essential to the long term health of the U.S. research effort in space astrophysics, while the experience of the Senior Researchers is needed to maximize the near-term research results in space astrophysics. Therefore, the intended funds distribution for this program element will favor proposals from Junior Researchers, provided that their proposals are on a par with those from Senior Researchers. The target is to award two-thirds of the available LTSA program funding for the LTSA to Junior Researchers, contingent upon the submission of an adequate number of highly ranked proposals, and the remaining one-third for Senior Researchers. During the last proposal review cycle, 51% of available funds were awarded to Junior Researchers.

Because of the duration of long term research projects, it is possible that a substantial portion of the necessary data will be obtained from future space astrophysics observations. However, approval of a LTSA proposal does not constitute approval of the specific observing programs contemplated or described by the proposer. It will be the proposer's responsibility to propose specific observations and to obtain the desired data

via the appropriate mission-specific observing programs or archival research programs. The cost portions of such observing or archival-data proposals should be very low; it may include requests for travel support or other costs, but may not duplicate any salary costs.

3. Proposal Category and Research Areas

Each LTSA proposal must be identified as to Junior or Senior category by checking the appropriate box on the Cover Page (see Appendix C.5.3 for instructions for electronically accessing and submitting the Cover Page). For all Types of LTSA proposals, the Cover Page also provides for designation of the Research Area, as defined below, that forms the primary focus of the proposal. The primary use of these Research Areas is to facilitate the assignment of the proposal to an appropriate review panel. Note that each proposal, regardless of Type, must identify one primary Research Area (a secondary Area may be designated if appropriate). NASA reserves the right to reassign a proposal to a different primary or secondary Research Area. The currently defined Research Areas are:

1. *Solar System including the Sun* (Note: proposals whose primary focus is solar system research using the IRAS Asteroid and Comet Survey or Voyager data should be submitted to other NRA's or program elements in this NRA that are relevant to those objectives) for this program element the solar observations are those of high-energy spectral and temporal studies of solar flares utilizing CGRO data;
2. *Star Formation and Pre-Main Sequence Stars* (star forming clouds, protoplanetary and debris disks, protostars, T Tauri stars);
3. *Main Sequence Stars*;
4. *Post-Main Sequence Stars and Collapsed Objects* (giants, isolated white dwarfs, isolated neutron stars, central stars of planetary nebulae, gamma-ray bursts);
5. *Binary Systems* (cataclysmic variables, x-ray binaries, black hole binaries);
6. *Interstellar Medium and Galactic Structure* (supernova remnants, dark clouds, interstellar dust, H II regions, diffuse galactic emission, planetary nebulae);
7. *Normal Galaxies* (-normal galaxies, interacting galaxies, starburst galaxies, Seyfert galaxies, quasars, radio galaxies);
8. *Active Galaxies and Quasars* (interacting, starburst, Seyfert and radio galaxies, AGN's, quasars);
9. *Large Scale Cosmic Structures* (clusters of galaxies, galaxy environment and evolution, intracluster medium, diffuse x-ray background, cosmology);
10. *Relativity and Gravitational Astrophysics* (tests of the fundamental laws of physics as relevant to astrophysics and cosmology).

4. Programmatic Information

This program was begun during the FY 1990 award cycle and currently provides support for about 90 research groups and individuals, with a budget level of approximately \$8.2M per year. It is anticipated that approximately \$2M will be available through this ROSS-2000 NRA for the funding of new awards for this program element, to fund proposals of a maximum of five years duration.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the Cover Page/Proposal Summary (see Appendix C.5.3) is TBD*; Hard copies of the proposals are to be delivered to:

ROSS-00 NASA Research Announcement
Long-Term Space Astrophysics Research Program
TBD*

*TBD: see SPECIAL NOTE (3) on p. 6 of the summary cover letter of this NRA.

For further information, contact the Discipline Scientist:

Dr. Daniel Golombek
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0247
E-mail: daniel.golombek@hq.nasa.gov

A.1.5 Astrophysics Theory Program (ATP)

1. Scope of Program

The Astrophysics Theory Program is intended to support efforts to develop basic theory needed for NASA's space astrophysics programs. The periods of performance of investigations that may be submitted for this research element ranges from one to three years, although most proposals that are selected have a duration of three years. Abstracts of currently funded ATP projects can be found [on line](http://spacescience.nasa.gov/research.htm) at <http://spacescience.nasa.gov/research.htm>.

Proposals submitted for the ATP should:

- be directly relevant to space astrophysics: the proposed studies should facilitate the interpretation of existing data from space astrophysics missions, foreign as well as domestic, or should lead to predictions that can be tested with space astrophysics observations; and
- address theoretical problems in space astrophysics that are either broadly applicable across astrophysics or narrowly focused on a particular subdiscipline of space astrophysics, for example, infrared and radio astrophysics, ultraviolet and visible astrophysics, high energy astrophysics, relativity and gravitational astrophysics (i.e., tests of the fundamental laws of physics as they are relevant to astrophysics and cosmology), and galactic cosmic ray/particle astrophysics; and
- consist predominantly of theoretical studies and the development of theoretical models that may also incidentally include data analysis and comparison tests of theory against data from space astrophysics missions.

Conversely, proposals to the Astrophysics Theory Program may not:

- consist primarily of data reduction or data analysis (such proposals should be directed to the mission-specific programs, the Astrophysics Data Program, or the Long-Term Space Astrophysics Research Program);
- address theoretical topics that are predominantly unrelated to space astrophysics needs (such proposals should be directed to the appropriate Federal agencies);
- deal strictly or predominantly with solar system objects or solar-terrestrial interaction studies, including solar energetic particles;
- request support for organizing and/or hosting scientific meetings; or
- request support for substantial computing facilities or resources.

2. Topic Categories

For the purposes of conducting the review, every proposal for this ATP must be labeled with one (or more, if appropriate) suggested Topic Categories from the current list below in both its Notice of Intent and in the proposal submission itself (note that the electronic format for the Cover Page will include a line for entry of one of these topics; see Section

C.5.3 of Appendix C). The primary use of these Topic Categories is to facilitate the assignment of the proposal to an appropriate review panel; NASA reserves the right to assign a proposal to a different Topic Category. The categories are:

1. *Star Formation and Pre-Main Sequence Stars* (star forming clouds, protoplanetary and debris disks, protostars, T Tauri stars, brown dwarfs; dust and astrochemistry)
2. *Main Sequence Stars*;
3. *Post-Main Sequence Stars and Collapsed Objects* (giants, isolated white dwarfs, isolated neutron stars, central stars of planetary nebulae);
4. *Binary Systems* (cataclysmic variables, x-ray binaries, black hole binaries);
5. *Interstellar Medium and Galactic Structure* (supernova remnants, dark clouds, interstellar dust, H II regions, diffuse galactic emission, planetary nebulae);
6. *Post-Main Sequence Stars and Collapsed Objects* (giants, isolated white dwarfs, isolated neutron stars, central stars of planetary nebulae, gamma-ray bursts);
7. *Normal Galaxies* (-normal galaxies, interacting galaxies, starburst galaxies, Seyfert galaxies, quasars, radio galaxies);
8. *Active Galaxies and Quasars* (interacting, starburst, Seyfert and radio galaxies, AGN's, quasars)
9. *Large Scale Cosmic Structures* (clusters of galaxies, galaxy environment and evolution, intracluster medium, diffuse x-ray background, cosmology)
10. *Cosmic Ray/Particle Astrophysics*
11. *Relativity and Gravitational Astrophysics* (tests of the fundamental laws of physics as they are relevant to astrophysics and cosmology).

3. Programmatic Considerations

Two types of proposals will be considered: Proposals from Principal Investigators who head research groups and proposals from individual researchers. A proposal from a research group must clearly justify the scientific need for and logic of the team effort; a set of unrelated or only loosely related research topics by several investigators does not constitute a valid group effort. All proposals, regardless of the size of their budget requests, are competitively reviewed against each other.

It is anticipated that approximately \$2.5M will be available through the ROSS-00 NRA to fund proposals, of nominally three years duration each, for the funding of new awards for this program element. The typical level of support per year is expected to be in the range of \$50K to \$100K for individuals and up to a maximum of \$300K for research groups. The file called "[ATP Statistics](#)" located with the abstracts of previously awarded ATP grants (see URL address above) also contains funding statistics for the last review cycle.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may

complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the Cover Page/Proposal Summary (see Appendix C.5) is TBD*. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Astrophysics Theory Program
TBD*

*TBD: see SPECIAL NOTE (3) in the summary cover letter of this NRA.

For further information, contact the Discipline Scientist for this program element:

Dr. Daniel Golombek
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0247
E-mail: daniel.golombek@hq.nasa.gov

A.2.1 Solar Physics Research, Analysis, and Low Cost Access to Space Program

1. Scope of Program

The Solar Physics program has as its objective the comprehensive study of all four solar and solar wind source research areas; these research areas are defined as the:

- Solar interior,
- Quiet solar atmosphere,
- Solar activity, and
- Solar corona.

Proposals focused on extended analysis of data demonstrably in the public domain from solar space science missions are encouraged, especially for data from the High Energy Solar Spectroscopic Imager (HESSI), to be launched in 2000 and operated under an open data policy. For further information on this missions see the [HESSI World Wide Web site](http://soleil.ssl.berkeley.edu/) at <http://soleil.ssl.berkeley.edu/>.

A. Solar Physics Supporting Research and Technology (SR&T) Program

The Solar Physics SR&T program supports investigations involving analyses of existing data that are demonstrably open in the public domain. Acceptable SR&T investigations include the development of theoretical models and numerical simulation techniques pertinent to solar physics, and, in special cases, the development or coordination of solar ground-based observing capabilities that support NASA Solar Physics flight programs. This Solar Physics SR&T program also supports the exploration and demonstration of new instrument concepts pertinent to discipline goals, but it does not support the development of major space flight instruments per se.

For purposes of the management of program balance, the NASA Solar Physics program element is organized into a matrix of five techniques, viz.,

- Development of Instrument Concepts,
- Ground- and Space-based Observations,
- Theory or Modeling,
- Data Analysis, and
- Ancillary Laboratory Research (*e.g.*, derivation of atomic constants, photometric calibrations, or simulation of solar phenomena),

for each of the four solar research areas noted above. Investigations in all matrix categories are invited. Proposals that seek to develop laboratory concepts for new instruments for future suborbital or orbital flight opportunities are especially welcome. Although no priorities are imposed on these categories, an ideal program is envisaged as a balance among them, consistent with the quality of submitted proposals and their relevance to the current Solar Physics flight programs. To aid in the identification of peer

reviewers, it is essential that the electronically submitted *Cover Sheet* for Solar Physics proposals include a single choice of discipline descriptor (e.g., Theory or Modeling/Corona; Ground-based Observations/Solar Interior; *etc.*) as the "Technique/Research Area" designation that will appear on the Web site format (see Section C.5.3 of Appendix C for directions).

As part of a mission-oriented agency, the Sun-Earth Connection theme seeks to fund those efforts that directly impact NASA missions or interpretation of their data. Solar research topics likely to contribute to the characterization and/or prediction of radiation exposure to astronauts are appropriate for this NRA. However, other investigations, even if of considerable merit, will not be given high priority for funding through this NRA if they are judged to be more appropriate for submission to other Federal agencies.

B. Low Cost Access to Space Program in Solar Physics.

The Solar Physics Low Cost Access to Space (LCAS) Program is expected to continue to lead the way in the development of instrument concepts for future solar missions. Proposals will also be considered, however, that address the current solar activity cycle maximum using a variety of methods for providing low cost access to space. These include standard and long-duration balloons, sounding rockets, Spartan and other Shuttle-based carriers, and sounding rocket-class payloads flown as secondary payloads or on other flights of opportunity. It is emphasized that a proposal for a Solar Physics LCAS Program must be for a complete science investigation, including data analysis and publication of results, even if these activities are projected to be done beyond the maximum three year period of performance. In a case like this, a follow-on proposal must be submitted for full peer review that documents the progress made in developing if not flying the payload, and that projects the steps necessary for data acquisition and reduction, and the publication of results.

2. Programmatic Information

Currently, the Solar Physics SR&T program has a distribution of one-, two-, and three-year grants. Therefore, only a portion of the program is available for competition each year. Total SR&T program funds in FY 2000 of \$6.2 M supported approximately 75 grants, of which about 25 will have expired by FY 2001, freeing a corresponding portion of the FY 2001 funds for proposals competing under the ROSS-2000 NRA.

The Solar Physics LCAS Program has approximately \$1.2 M available for selections made through this ROSS-2000 NRA of three to four suborbital investigations of up to three years duration each beginning in FY 2001.

The community should be reminded that the HESSI Small Explorer mission (Dr. Robert Lin, PI) is making available \$170K in annual funding for new Supporting Research and Technology grants of up to two years duration for investigations focussing on HESSI data. HESSI is expected to be launched in July, 2000. In SR&T proposals to this fund source, the Abstract should have words identifying the proposed effort as "focussing on HESSI data." The funding normally available each year for SR&T awards will be unaffected by these additional funds.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given Appendix A. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is TBD*. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Solar Physics Research, Analysis, and Suborbital Program
TBD*

*TBD: see SPECIAL NOTE (3) in the summary cover letter of this NRA.

Further information about this program may be obtained from the Discipline Scientist:

Dr. William J. Wagner
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington, DC 20546-0001
Telephone: (202)358-0911
Facsimile: (202)358-3097
E-mail: william.wagner@hq.nasa.gov

A.2.2 Heliospheric Physics

1. Scope of Program

This program element supports research aimed at understanding:

- How the Sun accelerates the solar wind and causes temporal and spatial variability in the solar wind;
- The global dynamic character of the heliosphere and the local particles and fields processes from that change with distance and in three dimensions, in response to solar activity and rotation;
- How the Sun interacts with our galaxy, the Milky Way, including the solar modulation of galactic cosmic rays; and
- Acceleration and interaction of energetic particles in the solar corona and heliosphere.

This program specifically supports research projects involving theory, simulation, and modeling directed towards the objectives of heliospheric science and energetic particles studies. Proposals focussed on extended analysis of data demonstrably in the public domain from space science missions are also encouraged. In addition, up to ten percent of the available funding may be used to support preliminary studies of new instrumental techniques for heliospheric sciences, if warranted by proposal merit and relevance to the Sun-Earth Connection strategic goals.

2. Programmatic Considerations

For the present transition year, \$1.2M in FY 2001 funds will be available in approximately equal amounts for proposals submitted for 1-, 2-, and 3-year investigations. Hence, such proposals are solicited with focused objectives in the science areas described above.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given Appendix A. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is TBD*. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Heliospheric Physics Program
TBD*

*TBD: see SPECIAL NOTE (3) in the summary cover letter of this NRA.

Questions concerning the program element may be addressed to the Discipline Scientists:

Dr. James C. Ling
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington DC 20546-0001
Telephone: (202) 358-0897
E-mail: james.ling@hq.nasa.gov

Dr. Madhulika Guhathakurta
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington DC 20546-0001
Telephone: (202) 358-1992
E-mail: lika@tristang.gsfc.nasa.gov

A.3 GEOSPACE SCIENCES

A.3.1. Scope of Program

Proposers interested in submitting in response to this program element should also read Section I. of the Introduction and Overview of Appendix A for an overview of the Sun-Earth Connection (SEC) science theme of the NASA Office of Space Science.

The Geospace Sciences Cluster seeks to understand the region of space that surrounds and is influenced by the Earth and its magnetic field, beginning with the investigation of the neutral upper atmosphere, including the mesosphere and thermosphere, and extending from there outwards through the ionosphere, into and beyond the magnetosphere. This Cluster also supports studies of similar phenomena and processes at other solar system bodies. These studies are supported primarily with the goal of enhancing and enabling the greatest possible scientific return from past and future NASA missions. Proposals with the intent of extending or directly supplementing investigations selected for current approved space flight missions are not appropriate for this NRA.

There are two components of the Geospace Sciences Cluster: the Supporting Research and Technology (SR&T) and the Geospace Low Cost Access to Space (G/LCAS) programs. In FY 2000 approximately two-thirds of the total funding supported SR&T investigations and one-third was invested in the G/LCAS program

The Geospace Sciences SR&T component supports individual research tasks that employ a variety of research techniques in pursuit of Geospace program goals. Specifically, the Geospace Sciences SR&T program supports theoretical research, the development and exercise of models and simulations, and the analysis and interpretation of data for the purposes of identifying and understanding the physical processes important to Geospace structure and dynamics. The development and testing of new instrument concepts, new observing techniques, and/or new data analysis techniques that are pertinent to discipline goals are also supported, providing the proposed activity is in the context of a clearly defined Geospace science problem. The program does not support the development of specific engineering, protoflight, or flight instrumentation nor the routine, long-term gathering of observational data. The Geospace SR&T program annually supports ~100 awards, with an average annual funding of \$80K per award.

The G/LCAS Program supports research in magnetospheric, ionospheric, thermospheric, and mesospheric physics that requires the space-flight of instrumentation. The program offers a variety of methods for providing low cost access to space. These include standard and long-duration balloons, sounding rockets, Shuttle-based carriers, the International Space Station, and sounding rocket-class payloads flown as secondary

payloads or on other flights of opportunity. The G/LCAS program annually supports approximately 15 investigations, each with an average annual funding of \$200-250K per investigation.

Some areas of study within the Sun-Earth Connection theme overlap with research objectives supported by other OSS disciplines. In particular, proposals dealing with the following disciplines are outside the purview of the Geospace program:

- the interaction of the solar wind and/or magnetospheric plasmas with solid body surfaces,
- the neutral components of planetary toruses, rings, and/or atmospheres of extra-terrestrial planets;
- the chemistry and/or dynamics of the lower, neutral terrestrial atmosphere (i.e., below the mesosphere).

3.2. Programmatic Issues

3.2.1 Supporting Research and Technology Program

In past years SR&T programs have permitted grants to be made separately to the Principal and Co-Investigators of the same investigation, but at different institutions, in order to avoid the overhead costs associated with subcontracts. However, this practice has been discontinued except in those unique cases where a Co-Investigator is affiliated with a U.S. Government Laboratory (see the subsection entitled *Budget Summary and Details* in Section 5.3 of Appendix C), in which case NASA separately funds that Co-Investigator through a direct transfer of funds. Separate Co-Investigator awards are also permitted in the LCAS program discussed below.

3.2.2 Geospace/Low Cost Access to Space (LCAS) Program

Selection is based on science merit, cost-effectiveness, and overall programmatic balance. Proposers may submit budgets for up to three years; these are expected to cover a complete suborbital investigation, including payload construction, launch phase, and data analysis.

It is necessary to minimize the operational costs to NASA for payload preparation and field operations for its Research Carriers programs. Investigators are, therefore, strongly encouraged to propose investigations that minimize these operational factors, especially with regard to payload complexity and nontraditional launch sites. All those who intend to propose to the G/LCAS program are strongly urged to discuss prospective investigations with operations personnel at the NASA Wallops Flight Facility in order to

ensure that probable operational costs are properly anticipated. Questions concerning sounding rockets should be addressed to:

Mr. Bobby Flowers
Sounding Rocket Program Office
Code 810
Wallops Flight Facility
National Aeronautics and Space Administration
Wallops Island, VA 23337
Telephone: (757) 824-2202
E-mail: bobby.j.flowers@gsfc.nasa.gov

Questions concerning balloon investigations should be addressed to:

Mr. Harvey Needleman
Balloon Program Office
Code 820
Wallops Flight Facility
National Aeronautics and Space Administration
Wallops Island, VA 23337
Telephone: (757) 824-1453
E-mail: harvey.c.needleman@gsfc.nasa.gov

Sounding Rocket Launch Sites. The two standard U.S. launch sites for sounding rockets are White Sands Missile Range (WSMR), New Mexico, and Wallops Island, Virginia. Although launches from Poker Flat Rocket Range (PFRR) in Alaska require support from mobile launch crews, they do not require separate “campaign” proposals (see below). However, prospective proposers should be aware that PFRR is closed in alternate years; current plans call for PFRR to be open during the winters of 2000-01 and 2002-03. Campaign proposals are also not required for the use of established non-U.S. launch sites such as those at Andoya, Norway, and Kiruna, Sweden.

Prospective investigators should note that NASA sounding rocket flights from WSMR require the payment by NASA of significant fees. While the current operations budget contains sufficient funds to support a small number of flights from WSMR every year, it is difficult to accommodate investigations with extended launch windows at WSMR.

Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED) Mission. The TIMED satellite is nominally scheduled for launch sometime in 2000, with science operations expected to extend at least through a two-year prime mission (see the on line pages for more information on [TIMED](http://www.timed.jhuapl.edu/home.htm) at <http://www.timed.jhuapl.edu/home.htm>). Certain G/LCAS investigations may benefit from and have their science return enhanced by coordination between the G/LCAS program and observations made by the TIMED

satellite. No additional funding is available, however, from either the TIMED program or the existing G/LCAS program, for the science programs specifically supporting the TIMED program. On the other hand, because of the possible aided value of TIMED observations to the achievement of the objectives of some G/LCAS investigations, technically and scientifically superior proposals that demonstrate the benefit of coordinated observations with TIMED will enjoy priority for selection.

Campaigns for Multiple Launches. In addition to flights from WSMR, Wallops Island, and PFRR, the G/LCAS program has historically been able to support up to one campaign per year consisting of a series of rockets flown from a common but nonstandard launch location. Campaigns are usually planned several years in advance. The only currently scheduled campaign is for PFRR during winter 2000-2001.

In proposing for a campaign, the following protocol must be followed:

- A Campaign Scientist should submit a "Campaign Summary" proposal describing the overall effort and listing prospective investigations. The Campaign Summary proposal should address the rationale for requesting the proposed launch site; the desired launch time and/or other special launch conditions (moon-down, night time, etc.); any expected non-U.S. involvement; required ground and/or airplane support; and any other information that defines the overall scope of the proposed campaign.
- Each investigator who wishes to participate in a campaign must submit a separate investigation proposal, each of which will be independently reviewed. Clear cross-reference must be made to the Campaign proposal on the proposal *Cover Sheet* (see Appendix C.5.3).

Proposals from Multiple Institutions. Proposals to the G/LCAS program often involve the development of payloads that require collaboration among several institutions. In such cases, the lead PI may propose a direct subcontracting arrangement between the PI institution and the Co-I institutions. To avoid the payment of multiple overhead fees, however, NASA may prefer to provide separate awards to each institution involved in such multiple institutional investigations, with an investigator from each Co-Investigator institution serving as the *Institutional PI* for the award to that institution (see special provisions Section C.1.3 in Appendix C of this NRA). The following applies to G/LCAS proposals involving such separately funded contributions from multiple institutions.

- Only the primary proposal for the overall investigation, submitted by the single Principal Investigator, will be reviewed. This primary proposal must include the PI's work statement and budget, followed by short task statements and budgets from all other collaborating Co-I institutions. The *Cover Sheet* of the primary proposal must show separately the dollar amounts requested by the leading institution and each Co-I institution, plus the yearly total requests for the total investigation.

- The appended task statement(s) from Co-I collaborating institution(s), not to exceed five pages, must describe that institution's contribution to the investigation, the roles of the Co-I(s) at that institution (if more than one, a single investigator to serve as the *Institutional* PI for that institution must be chosen), and a summary budget for the task following the formats as specified in Appendix C.
- Each Co-I institution must additionally submit a formal, signed proposal incorporating the task statement noted above, all prefatory materials indicated in Appendix C, and a full institutional budget. Such Co-I proposals must be clearly cross-referenced on the Cover sheet to the lead PI proposal and must have the same title as the PI proposal.

G/LCAS program proposals selected under this NRA will be phased into the program as rapidly as resources permit. As a rule, new investigations are awarded definition-level funding in their first year, full funding for development in their second year, leading to flight early in their third year, which concludes with data analysis.

Owing to the larger scope and personnel involvement in G/LCAS proposals, the page limit for the *Science/Technical/Management Section* given in Section C.5.2 of Appendix C is revised from the default standard of 15 pages to 20 pages instead.

3.2.3 Programmatic Information

Total funding for the Geospace Cluster is nominally \$12M per year. It is anticipated that approximately \$4M of this total funding will be available for competition in FY 2001.

Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is TBD*. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Geospace Program
 TBD*

*TBD: see SPECIAL NOTE (3) in the summary cover letter of this NRA.

Further information may be obtained from the Discipline Scientists:

Dr. Mary Mellott
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0893
Facsimile: (202) 358-3097
E-mail: mary.mellott@hq.nasa.gov

Dr. James Sharber
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0894
Facsimile: (202) 358-3097
E-mail: james.sharber@hq.nasa.gov

A.4.1 Cosmochemistry Program (CCP)

1. Scope of Program

The Cosmochemistry Program (CCP) supports scientific investigations that may involve laboratory studies of a variety of extraterrestrial materials (meteorites, cosmic dust, and lunar samples), that are cosmochemical in nature, or that are aimed at understanding the geochemical nature of the solar system bodies (planets, satellites including the Earth's Moon and satellites of the outer planets, and small solar system bodies); or cosmochemical studies concerned with the formation and chemical development of the solar system. The goals of this program are to support cosmochemical research projects that increase the understanding of the origin of the solar system, and the processes by which its planets and small bodies have evolved to their present state; and/or yield direct information about the formation of the solar system, the exact time scales for planetary formation and history, the nature and development of planetary surfaces, and the past activity of the Sun and cosmic rays. NASA is particularly interested in proposals for sample research projects that closely support its activities for exploring the solar system; determining its nature, origin, and history; and/or that contribute to the development of techniques for such further exploration. Individual investigations may involve direct measurements of physical and chemical properties, or research efforts that contribute new data, that analyze and synthesize existing data, or that combine both kinds of activities.

Examples of the kinds of research supported by this program include:

- cosmochemical studies of solar system formation;
- studies of chemical differentiation of planetary bodies;
- laboratory studies of phase stability, thermal emission, chemical partitioning, and other processes necessary to interpret planetary data;
- synthesis of previously obtained geochemical data;
- direct measurements of mineral compositions, major and trace element chemistry, isotopic compositions, radiometric ages, magnetism, radiation exposure effects;
- petrologic studies of materials from Solar System bodies;
- lunar geochemical and petrologic studies, lunar craters and microcraters, lunar physical and mechanical properties; and
- proposals that are designed to obtain basic scientific information that might enable the utilization of extraterrestrial resources.

However, the CCP will not consider proposals that are designed to demonstrate a technology that could be important to extraterrestrial resource utilization. Though no priorities are imposed on the general kinds of investigations, an ideal program is envisaged as a balance among these objectives, consistent with the quality of submitted proposals and their relevance to the current CCP.

This program is also interested in supporting certain types of research on terrestrial samples or with terrestrial analogs when such efforts contribute to overall program goals in cosmochemistry. Specific objectives of such terrestrial research should address key geochemical processes in early terrestrial evolution; terrestrial history in terms of general solar system processes; or the reasons for differences in evolution among the various planetary bodies, including Earth, the Moon, and parent bodies of meteorites. Proposals to analyze terrestrial samples or their analogs should clearly develop the nature of the planetary connection. The specific connection to the wider range of planetary processes is a key factor in determining the success of such proposals.

Proposals for topical conferences, workshops, symposia, or other new initiatives related to the Cosmochemistry Program are also solicited through this NRA. For more information about the type of research supported by this program, abstracts for currently funded investigations are available on line at <http://spacescience.nasa.gov/codesr/welcome.html> .

An important goal of the Astronomical Search for Origins and the Solar System Exploration efforts is to facilitate access to data and extraterrestrial sample material for certain scientific and educational purposes, in addition to NASA-supported research projects. The NASA Johnson Space Center, Houston, TX, is responsible for the security and access to the lunar sample collection, as well as the interplanetary dust particles collected by high altitude aircraft and meteorites collected in the Antarctic by field parties supported by the National Science Foundation (NSF). For information on how to obtain any of the specimens in these collection, contact:

Office of the Curator
Code SN21
Johnson Space Center
National Aeronautics and Space Administration
Houston, TX 77058-3696.

2. Programmatic Considerations

The National Science Foundation (NSF) may consider a wide range of proposals (from domestic organizations only) that contribute new knowledge in the area of cosmochemistry and related fields. The same proposal may be submitted to both NASA and NSF if desired; however, such proposals must clearly state they are being submitted to both agencies in the proposal section entitled *Current and Pending Support* (see Section 5.3 of Appendix C).

It is estimated that the funding level for this program for Fiscal Year 2001 will be approximately \$12.4M and that this level of funding will support approximately 105 research investigations, including both new proposals, as well as in-progress multiple year awards for which progress reports are due. Awards under this NRA are subject to the availability of funds.

Progress Reports: Holders of existing Cosmochemistry multiple year awards (e.g., the second or third year of a three-year award from a previous NRA) must submit a request for an annual funding allotment of their award in the form of a *Progress Report*, by the same deadline given in Table 1 for new proposals for this program element. These *Progress Reports* will be screened by the peer review panel that will be reviewing new proposals to aid NASA's evaluation of progress. The Project Description in such a request for allotment, including a report of progress made during the past year, should be limited to no more than three single-spaced, typewritten pages and include a brief statement of planned work for the coming year, a report of progress made during the previous year, a budget, and an estimate of the amount of previously awarded funds that will remain available at the end of the award year. The three page limit does not include a *Cover Page*, a listing of proposal personnel, *Proposal Summary* (Abstract), *Budget Summary*, *Table of Contents*, references, figures, requests for equipment augmentations, detailed budgetary information, reprints, or appendices.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* is <http://www.lpi.usra.edu/panel> ; for technical assistance, contact 281-486-2137 or E-mail to panel@lpi.usra.edu . Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement

Cosmochemistry Program

Lunar and Planetary Institute

3600 Bay Area Boulevard

Houston, TX 77058

Phone number for commercial delivery: 281-486-2166.

Obtain additional information from the Discipline Scientist:

Mr. Joseph M. Boyce

Research Program Management Division

Code SR

Office of Space Science

NASA Headquarters

Washington, DC 20546-001

Telephone: (202) 358-0302

FAX: (202) 358-3097

E-mail: joseph.boyce@hq.nasa.gov

A.4.2 Planetary Geology and Geophysics (PGG) Program

1. Scope of Program

The Planetary Geology and Geophysics (PGG) program supports scientific investigations of the Solar System's planetary surfaces and interiors, satellites (including the Moon), satellite and ring systems, and smaller bodies such as asteroids and comets. The goals of the PGG program are to foster the gathering, synthesis, analysis, and comparative study of data that will improve the understanding of the extent and influence of planetary geological and geophysical processes on the bodies of the solar system, the origin and evolution of the solar system, and the nature of Earth and its history in comparison with other planets.

The PGG program supports research investigations relevant to the scientific interpretation of released data from past and existing planetary missions, as well as the science objectives of future missions. These investigations involve several types of research efforts such as, but not limited to: analysis and synthesis of existing data; theoretical and numerical modeling of data and processes; generation of new basic data in a laboratory environment; and combinations of these kinds of activities. Examples of the kinds of research supported by this program include:

- direct analysis of released data from planetary missions;
- theoretical modeling of geologic and geophysical processes;
- photogeologic analysis and geologic interpretation of planetary surfaces;
- compositional and geologic mapping of planetary surfaces;
- laboratory and remote sensing studies;
- experimental studies of materials under conditions relevant to objects in the solar system;
- theoretical studies of the interiors of planetary bodies;
- the dynamical evolution of the planets, satellites, small solar-system bodies, and ring systems;
- geologic field studies of terrestrial analogs to planetary phenomena in the context of providing a better understanding of the planetary phenomena, and
- studies related to the origin and evolution of volatiles in solid planetary bodies

In addition, the program supports the development and production of cartographic products of planetary data sets. Proposals to study or develop flight instruments or study future planetary missions are beyond the scope of this program.

Proposed investigations of any planetary or satellite surface that are intended, as a by-product of the scientific research, to produce a geologic map suitable for publication by the U.S. Geological Survey (USGS) should check the relevant box on the *Cover Sheet* (see Section 5.3 of Appendix C) and clearly indicate this intention in the *Proposal Summary*, as well as the text of the proposal. Information on geologic maps that have been produced or are currently in production may be obtained from [Dr. Kenneth Tanaka](#) of the USGS or from the World Wide Web PGM page (http://www.flag.wr.usgs.gov/USGSFlag/Space/GEOMAP/PGM_home.html).

Efforts to acquire observations of planetary surfaces and interiors may produce data of wide scientific interest. It is expected that these data sets would, after a reasonable amount of time, be archived within the Planetary Data System (PDS). Contact R. E. Arvidson (PDS Geoscience Node) for further information regarding the types of data sets that might be of interest for archiving purposes (E-mail: arvidson@wunder.wustl.edu or telephone (314) 935-5609).

2. Experimental Facilities Available for the PGG Program

The following facilities are widely available to investigators supported by the PGG program and, therefore, their use may be discussed in the submitted proposals (especially note the provision for such discussion in the proposal section entitled *Facilities and Equipment*, in Section 5.3 of Appendix C).

- Planetary Aeolian Facility: The Planetary Aeolian Facility at the NASA Ames Research Center consists of wind tunnels to simulate atmosphere-surface interactions on Earth, Mars, and Venus. For more information contact:

Dr. Ronald Greeley
Department of Geology
Arizona State University
Tempe, AZ 85287
Telephone: (602) 965-7029
Facsimile: (602) 965-8102
E-mail: greeley@asu.edu

- Reflectance Experiment Laboratory (RELAB): The RELAB facility at Brown University provides a mechanism for researchers to obtain laboratory spectra of geologic materials for use in compositional and/or geologic applications. The RELAB is supported by NASA as a multiuser spectroscopy facility and laboratory time can be made available at no charge to investigators funded by NASA programs. For information on this facility and/or requests to receive a *RELAB User's Manual*, contact:

Dr. Carle M. Pieters
RELAB Science Manager
Department of Geological Sciences
Box 1846
Brown University
Providence, RI 02912
Telephone: (401) 863-2417
Facsimile: (401) 863-3978
E-mail: pieters@porter.geo.brown.edu

- NASA Ames Vertical Gun Range (AVGR): The NASA AVGR is a national facility funded by the NASA Office of Space Sciences to enable investigations of impact phenomena and processes. Exploratory or proof-of-concept programs requiring a limited number of experiments can be accommodated at no cost. More extensive programs are subject to review in order to assess feasibility and cost effectiveness. For more information, potential users of the AVGR should contact:

Dr. Peter Schultz
Department of Geological Sciences
Box 1846
Brown University
Providence, RI 02912
Telephone: (401) 863-2417
Facsimile: (401) 863-3978
E-mail: peter_schultz@brown.edu

3. Data Sources Available for the PGG Program

Prospective proposers should be aware of sources for data that might be used in their research and whether the required data are available. Useful contacts for making these determinations are given below:

- General Lunar and Planetary Information: The Lunar and Planetary Institute (LPI) is the most concentrated and readily accessible source of information in lunar and planetary science. Information about its services can be found at <http://www.lpi.usra.edu/> or by contacting:

Director
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Telephone: (281) 486-2180

- Data from Completed NASA Flight Programs: The National Space Science Data Center (NSSDC) stores digital and other data from completed flight experiments. Such data include: (1) lunar and planetary photographs, (2) digital planetary images, (3) data from numerous flight experiments, and (4) lunar cartographic products. Investigators are responsible for acquiring the data needed for their proposal. Modest requests for imaging and nonimaging data are free of charge, while charges will be made for large requests. Requests from U.S. investigators for data products and information may be made to:

National Space Science Data Center
Code 633.4
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771
Telephone: (301) 286-6695

while requests from non-U.S. investigators for NSSDC data products and product availability information may be made to:

World Data Center for Rockets and Satellites
Code 633
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771
USA
Telephone: (301) 286-6695

- Planetary Cartographic Products: A variety of planetary cartographic products such as topographic, orthophoto, geological, and other special maps and geodetic information are available. Requests from NASA-funded investigators for production of special maps or other cartographic materials will be accommodated when possible. Request available data or specific maps from:

Branch of Distribution
U.S. Geological Survey
Federal Center
Box 25286
Denver, CO 80225
Telephone: (303) 236-7477

Request information related to the availability of base maps and related materials or U.S. Geological Survey criteria for map publication from the World Wide Web http://www.flag.wr.usgs.gov/USGSFlag/Space/GEOMAP/PGM_home.html and/or contact:

Branch of Astrogeology
U.S. Geological Survey
2255 North Gemini Drive
Flagstaff, AZ 86001
Telephone: (602) 556-7262

- Regional Planetary Image Facilities: Regional Planetary Image Facilities (RPIF's) contain nearly half a million images of the planets and their satellites taken both from Earth and manned and unmanned spacecraft, as well as topographic and geologic maps produced from these images. The RPIF's, located at institutions worldwide, are intended for use by individuals and groups who use photographic and cartographic materials of the planets and satellites in their research programs. These programs include geologic, photometric, colorimetric, photogrammetric, and atmospheric dynamical studies.

In addition to the local scientists and their associates who use these data on a daily basis, investigators throughout the world are encouraged to use the RPIF's. Send inquiries to the nearest facility in care of the Director, Regional Planetary Image Facility. Note that while these centers may be used for on-site study and selection of planetary and satellite images, they are not facilities for the production of photographs for users. Instead such materials may be obtained from the NSSDC at the NASA Goddard Space Flight Center at the address given above. Additional information, including a listing of RPIF locations worldwide, can be found on the RPIF home page <http://cass.jsc.nasa.gov/library/RPIF/RPIF.html>.

- Decalibrated Digital Planetary Image Data: Digital planetary image data are available through the discipline nodes of the Planetary Data System. Submit requests for imaging data and support documentation to:

Planetary Data System/Imaging Node
U.S. Geological Survey
2255 North Gemini Drive
Flagstaff, AZ 86001
Telephone: (602) 556-7262

while requests for other planetary geoscience data may be submitted to:

Planetary Data System/Geosciences Node
Washington University
Campus Box 1169
One Brookings Drive
St. Louis, MO 63130
Telephone: (314) 935-6652

4. Programmatic Information

The PGG program is expected to support approximately 150 investigations, including both new proposals and in-progress multiple year awards, in FY 2001. Of these, approximately 60 investigations are expected to be selected through this NRA. All proposals must be received at the Lunar and Planetary Institute (see next page for address) by the close of business on the date given in Table 1 or they may not be considered for funding (see general policy on late proposals in Appendix C.1.1).

Holders of existing PGG multiple year awards (e.g., the second or third year of a three-year award from a previous NRA) must submit five (5) copies of a request for an annual funding allotment of their award in the form of a *Progress Report by the same deadline* as given in Appendix A for new proposals for this program element. These *Progress Reports* will be screened by the peer review panel that will be reviewing new proposals to aid NASA's evaluation of progress. The Project Description in such a request for allotment, including a report of progress made during the past year, should be limited to no more than five single-spaced, typewritten pages and include a brief statement of planned work for the coming year, a report of progress made during the previous year, a budget, and an estimate of the amount of previously awarded funds that will remain available at the end of the award year. The five page limit does not include a *Cover Page*, a listing of proposal personnel, a one page (or less) *Proposal Summary* (Abstract), *Budget Summary*, *Table of Contents*, *PI Current and Pending Support*, references, figures, requests for equipment augmentations, detailed budgetary information, reprints, or appendices. Please note that Letters of Commitment for Co-I's and collaborators are not required on *Progress Reports* unless there are new participants that did not submit letters with the original proposal.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal is given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the *Cover Page/Proposal Summary* (see Appendix C.5) is <http://www.lpi.usra.edu/panel/> ; proposers without access to the Web or who experience difficulty in using this site may contact The Lunar and Planetary Institute for assistance by phone at (281) 486-2137 or by E-mail to panel@lpi.usra.edu . Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Planetary Geology and Geophysics Program

The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058

Phone number for commercial delivery: (281) 486-2166

Additional information may be obtained from Discipline Scientist:

Dr. John A. Grant
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0294
E-mail: john.grant@hq.nasa.gov

A.4.3 Origins of Solar Systems Program (OSSP)

1. Scope of Program

This program element solicits basic research proposals to conduct scientific investigations related to understanding the formation and early evolution of planetary systems and to provide the fundamental research and analysis necessary to detect and characterize other planetary systems. These investigations may involve analytical and numerical modeling, laboratory research, and observational studies in the following areas: star formation and the relationship to planetary system formation, solar nebula processes, accumulation and dynamical evolution, analysis of primitive materials, and the detection of other planetary systems. The investigations supported through this NRA should directly support the goals related to understanding planetary system formation.

For example, key questions addressed by the research activities supported by this program may include: What was the initial mass, structure, motions, and temperature of the solar nebula, and the time scales over which planets formed? What are the conditions of star formation that lead to a single star surrounded by a protoplanetary disk? How was angular momentum transported in the nebula? What determined the masses of the giant planets? By what mechanism did the most primitive bodies in the solar system accumulate? What factors influence the growth of planetary embryos into planets? What processes were responsible for the patterns of chemical fractionation observed in the primitive meteorites and the volatile abundances in the planets? What is the frequency of the occurrence of planetary systems?

This Origins program realizes the existing potential for complementary interdisciplinary efforts to solve key scientific questions. To achieve this goal, proposals are encouraged that involve joint research efforts by investigators from different scientific communities. Interdisciplinary investigations may include, for example, studies of nebular chemistry and dynamics to understand the composition of primitive volatile-rich solar system bodies, or collaborations between observational astronomers and modelers to study the initial collapse of a protostellar cloud to form a nebula. Proposals that involve joint efforts may be submitted as separate proposals from participating institutions for each of their respective part of the investigation or as an a single all inclusive proposal. With respect to all inclusive proposals, proposers should keep in mind that it is the OSS policy that all subcontracts for work at an institution other than the lead institution must be handled by the lead institution.

Proposals for topical conferences, workshops, symposia, or other new initiatives related to the Origins program are also solicited through this NRA. For more information about the type of research supported by this program, abstracts for currently funded investigations are available at <http://spacescience.nasa.gov/codesr/welcome.html> .

2. Programmatic Information

It is estimated that the funding level for this program for fiscal year 2001 will be approximately \$5M and that this level of funding will support approximately 105 research investigations, including both new proposals and in-progress multiple year proposals. Awards under this NRA are subject to the availability of program funds.

Progress Reports: Holders of existing OSSP multiple year awards (e.g., the second or third year of a three-year award from a previous NRA) must submit a request for an annual funding allotment of their award in the form of a *Progress Report* by the same deadline as given in Table 1 for new proposals for this program element. These *Progress Reports* will be screened by the peer review panel that will be reviewing new proposals to aid NASA's evaluation of progress. The Project Description in such a request for allotment, including a report of progress made during the past year, should be limited to no more than three single-spaced, typewritten pages and include a brief statement of planned work for the coming year, a report of progress made during the previous year, a budget, and an estimate of the amount of previously awarded funds that will remain available at the end of the award year. The three page limit does not include a *Cover Page*, a listing of proposal personnel, *Proposal Summary* (Abstract), *Budget Summary*, *Table of Contents*, references, figures, requests for equipment augmentations, detailed budgetary information, reprints, or appendices.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5) is <http://www.lpi.usra.edu/panel> ; for technical assistance, contact 281-486-2137 or E-mail to panel@lpi.usra.edu . Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Origins of Solar Systems Program
Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058

Phone number for commercial delivery: 281-486-2166.

Obtain additional information from the Discipline Scientist:

Mr. Joseph M. Boyce
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0302
Email: joseph.boyce@hq.nasa.gov

A.4.4 Mars Data Analysis Program (MDAP)

1. Scope of Program

The objective of the Mars Data Analysis Program (MDAP) is to enhance the scientific return from the Mars Pathfinder (MPF) and Mars Global Surveyor (MGS) missions by broadening the scientific participation in the analysis of the MPF and MGS data and to fund high priority areas of research that support planning for future Mars missions. The MDAP supports scientific investigations using data obtained during and after the aerobraking phase of MGS and data obtained by MPF in its primary and extended mission phases on the surface of Mars. Where justified to support planning for future Mars missions, investigations that use as their basis data collected by other spacecraft (e.g., Viking, Mariner 9) will also be considered.

An investigator may propose a study (scientific, landing site science, cartographic, topographic, geodetic research) based on analysis of Mars data collected by the MPF and MGS missions (additional information about the MPF and MGS missions, and references containing preliminary science results can be found on the Mars Program homepage (<http://mpfwww.jpl.nasa.gov>)). In addition, correlative studies that use Mars data from another source with flight mission data to further the understanding of some aspect of Mars science are also included in this category. The other data could come from ground-based observations or from other spacecraft. Funds awarded for correlative studies will be used to cover data analysis and expenses involved in collaboration with other Mars investigators. Funds will not be authorized for taking new observations or for support of observing facilities. In anticipation that selected investigations may result in by-products (e.g., mineral, topographic, planometric, cartographic, and geologic maps, and calibration data) that are of broad use to the science community, a plan for archiving and making such by-products readily available must be included in the proposal. Approximately \$3.1M will be provided to support proposals that are selected that address these objectives.

An investigator may also propose a study(s) in the following high priority areas of research that support planning for future Mars missions: (i) improvement of atmospheric models that further the understanding and forecasting of atmospheric conditions that affect aerobraking and aerocapture; (ii) characterization of potential landing sites for future Mars Surveyor missions '01, '03, and '05 (e.g., distribution and size of rocks, pits, sand dunes, regional and local slopes, and altitude for mission hazard analysis); (iii) improved models for the gravity field, global topography, and global aeroid; (iv) improvement of the geodetic network of Mars for precision landing demonstration; and (iv) analysis and comparison of the Mars orbital and surface data to increase the predictive accuracy of surface characteristics of Mars from orbit. Approximately \$2.0M will be provided to support proposals that are selected that address these objectives, which increases the total MDAP budget from approximately \$3.1M to \$5.1M.

Proposals for topical conferences, workshops, consortia, symposia, or other new initiatives related to MDAP are also solicited through this NRA. For more information about the type of research supported by this program, abstracts for currently funded investigations are available on line at <http://spacescience.nasa.gov/codesr/welcome.html>.

2. Sources of Information and Data

It is the responsibility of the investigator to acquire any required data. Before submitting a proposal, each proposer should determine that the required data are available. MPF, MGS, and data from previous Mars missions are available from the Planetary Data System (PDS) that can be accessed at <http://pds.jpl.nasa.gov/pdsmdap.htm>. Proposers who wish to use photographic and cartographic materials may find such data at the nearest Regional Planetary Image Facility (RPIF). Locations of RPIF's are listed on the RPIF home page <http://cass.jsc.nasa.gov/library/RPIF/RPIF.html>.

3. Programmatic Information

The MDAP is envisioned to be a multiyear program that will support analysis of data returned by the planned series of Mars Surveyor missions over the next decade. It is anticipated that approximately \$5.1M will be available for the MDAP in Fiscal Year 2001. It is estimated that 75 to 100 investigations (both new and in-progress multiple-year proposals) may be selected from proposals submitted in response to this Announcement. Investigations may be proposed for a one-, two-, or three-year period of performance. Funding of investigations will be phased to ensure new starts each successive year of the program. Awards under this NRA are subject to availability of program funds.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

Holders of existing MDAP multiple year awards (e.g., the second- or third-year award from a previous NRA) must submit a request for an annual funding allotment of their award in the form of a *Progress Report by the same deadline* given in Table 1 for new proposals for this program element. These *Progress Reports* will be screened by the peer review panel that will be reviewing new proposals to aid NASA's evaluation of progress. The Project Description in such a request for allotment, including a report of progress made during the past year, should be limited to no more than five single-spaced,

typewritten pages and include a brief statement of planned work for the coming year, a report of progress made during the previous year, a budget, and an estimate of the amount of previously awarded funds that remain available at the end of the award year. The five page limit does not include a Cover Page, a listing of proposal personnel, *Proposal Summary* (Abstract), *Budget Summary*, *Table of Contents*, references, figures, requests for equipment augmentations, detailed budgetary information, reprints, or appendices.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5) is <http://www.lpi.usra.edu/panel> ; for technical assistance, contact 281-486-2137 or E-mail to panel@lpi.usra.edu . Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement

Mars Data Analysis Program

Lunar and Planetary Institute

3600 Bay Area Boulevard.

Houston, TX 77058

Phone number for commercial delivery: 281-486-2166.

Obtain additional information from the Discipline Scientist:

Mr. Joseph M. Boyce

Research Program Management Division

Code SR

Office of Space Science

NASA Headquarters

Washington, DC 20546-0001

Telephone: (202) 358-0302

E-mail: joseph.boyce@hq.nasa.gov

A.4.5 Lunar Data Analysis Program

1. Scope of Program

The objective of the Lunar Data Analysis Program (LDAP) is to enhance the scientific return from the Lunar Prospector Missions (LPM) by broadening the scientific participation in the analysis of the LPM data. The LDAP supports scientific investigations using data obtained during the primary mission phase.

An investigator may propose a study (scientific, cartographic, topographic, geodetic research) based on analysis of Lunar data collected by LPM (additional information about LPM and references containing preliminary science results can be found on the Lunar Prospector Mission homepage <http://lunar.arc.nasa.gov/> . In addition, correlative studies that use Lunar data from another source with LPM flight mission data to further the understanding of some aspect of Lunar science are also included in this category. The other data could come from ground-based observations or from other spacecraft. Funds awarded for correlative studies will be used to cover data analysis and expenses involved in collaboration with other Lunar investigators. Funds will not be authorized for taking new observations or for support of observing facilities. In anticipation that selected investigations may result in by-products (e.g., compositional, topographic, planometric, cartographic, and geologic maps, and calibration data) that are of broad use to the science community, a plan for archiving and making such by-products readily available must be included in the proposal.

Proposals for topical conferences, workshops, consortia, symposia, or other new initiatives related to LDAP are also solicited through this NRA. For more information about the type of research supported by this program, abstracts for currently funded investigations are available on line at <http://spacescience.nasa.gov/codesr/welcome.html> .

2. Sources of Information and Data

It is the responsibility of the investigator to acquire any required data. Before submitting a proposal, each proposer should determine that the required data are available. LDAP, as well as data from previous Lunar missions, are available from the Planetary Data System (PDS) that can be accessed on the <http://pds.jpl.nasa.gov/pdsldap.htm>. Proposers who wish to use photographic and cartographic materials may find such data at the nearest Regional Planetary Image Facility (RPIF). Locations of RPIF's are listed on the RPIF home page: <http://cass.jsc.nasa.gov/library/RPIF/RPIF.html> . Additional information about the Lunar Prospector Mission can be found on the Lunar Prospector Mission homepage: <http://lunar.arc.nasa.gov/> .

3. Programmatic Information

The LDAP is planned as a multiyear program but because of current funding limitations it is not possible to start any new proposals in Fiscal Year 2001. Therefore, LDAP proposals are not solicited in response to this ROSS-2000 Announcement. Should funds become available for the support of new proposals, a special addendum to this NRA will be released.

Holders of existing LDAP multiple year awards (e.g., the second- or third-year award from a previous NRA) must submit a request for an annual funding allotment of their award in the form of a *Progress Report* by December 1, 2000. Further details will be provided in a timely way by the NASA LDAP Program Scientist.

A.5.1 Planetary Astronomy

1. Scope of Program

The Planetary Astronomy Program supports ground-based telescopic observations that contribute to the understanding of the general properties and evolution of the planets and their satellites and of asteroids and comets. The Planetary Astronomy Program as now redefined includes observations made over a wide range of wavelengths from ultraviolet to radio and their analysis. The data obtained must be useful for basic research in support of planetary program objectives that either cannot be met by current spacecraft missions or directly support specific flight missions. Proposals are sought for new projects that fall within the scope of the Planetary Astronomy Program. Ground-based observations that supplement NASA missions that will be returning significant amounts of data within the next three years are especially encouraged.

2. Programmatic Considerations

Presently about \$7.2M is budgeted for this program, of which \$2.7M is dedicated to facilities support (principally the Infrared Telescope Facility (IRTF)). Approximately 80 investigations are supported with the remaining funds. Approximately one-third of these awards are expiring, allowing proposers to this ROSS-2000 NRA to compete for about \$1.5M.

As a departure from past nomenclature for this program element, and in accordance with Section C.3 of Appendix C, all proposals for this Planetary Astronomy program are now considered “new” regardless of past funding history, i.e., the old term of “Renewal (Full) Proposal” is no longer used. However, proposals that are a logical follow-on to work that has been selected and funded through previous Planetary Astronomy NRA’s should provide their existing NASA award number on the requested *Cover Page*, and describe the work that has been accomplished both in the required *Program Summary*, as well as in the body of the *Science/Technical/Management* section (see Appendix C.5.3).

The Planetary Astronomy program requires submission of the signed original plus 19 copies instead of the default number of 15 copies given in the summary cover letter of this NRA.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the summary cover letter. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <http://www.lpi.usra.edu/panel> ; proposers without access to the Web or who experience difficulty in using this site may contact the Lunar and Planetary Institute by E-mail at panel@lpi.usra.edu or by phone at (281) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement

Planetary Astronomy Program

The Lunar and Planetary Institute

3600 Bay Area Boulevard

Houston, TX 77058

Phone number for commercial delivery (281) 486-2166

Additional information may be obtained from the Discipline Scientist:

Dr. Thomas Morgan

Research Program Management Division

Code SR

Office of Space Science

NASA Headquarters

Washington, DC 20546-0001

Telephone: (202) 358-0828

E-mail: thomas.morgan@hq.nasa.gov

A.5.2. Near Earth Object Observations Program

1. Scope of Program

The Near Earth Object (NEO) Observations program supports ground-based telescopic observations to inventory the population of Near Earth Objects and to characterize a representative sample of them. However, the highest priority of this NEO program is to inventory the population of these objects. Therefore, NASA seeks investigations that promise a sustained, productive search for NEO's or that obtain follow-up observations of sufficient astrometric precision to allow the accurate prediction of their orbits.

This program also seeks to characterize NEO's to the maximum extent possible, by measuring the sizes, shapes, and compositions of newly discovered objects. This objective is of lower priority than that of discovery and orbit determination. However, it is deemed important from the standpoint of identifying potential targets of future space flight missions that NASA or other U.S. space agencies may sponsor.

2. Programmatic Considerations

Presently, about \$3.5M is budgeted for this program, of which approximately \$0.5M is dedicated to program office support at NASA's Jet Propulsion Laboratory. Approximately 15 investigations are currently supported with the remaining funds. Owing to the expiration of some of the current awards, approximately \$1.2M will be open for competition through this ROSS-2000 NRA.

As a departure from past nomenclature for this program element, and in accordance with Section C.3 of Appendix C, all proposals for this NEO Observations program are now considered "new" regardless of past funding history, i.e., the old term of "Renewal (Full) Proposal" is no longer used. However, proposals for NEO observations that are a logical follow-on to work that has been selected and funded through previous Planetary Astronomy NRA's (where all previous NEO work would have been submitted) should provide their existing NASA award number on the requested *Cover Page*, and describe the work that has been accomplished both in the required *Program Summary*, as well as in the body of the *Science/Technical/Management* section (see Appendix C.5.3).

The Near Earth Object Observations program requires submission of the signed original plus 19 copies instead of the default number of 15 as given in the in the summary cover letter of this NRA.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the summary cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <http://www.lpi.usra.edu/panel>. Proposers without access to the Web or who experience difficulty in using this site may contact the Lunar and Planetary Institute by E-mail at panel@lpi.usra.edu or by phone at (281) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Near Earth Object (NEO) Observations program
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Phone number for commercial delivery (281) 486-2166

Additional information may be obtained from the Discipline Scientist:

Dr. Thomas Morgan
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0828
E-mail: thomas.morgan@hq.nasa.gov

A.5.3 Planetary Atmospheres Program

1. Scope of Program

The Planetary Atmospheres program activity supports scientific investigations that contribute to the understanding of the general properties, origins, and evolution of the neutral and ionized atmospheres of planets and their satellites and of comets. Its broad objectives include the determination of compositions and chemical behaviors of planetary atmospheres; sources of and mechanisms for deposition of energy; characterization, and understanding of dynamical processes; and relationships between currently observed properties and/or states of matter, chemical abundances, physical conditions, and processes that prevailed at the time the planets were formed. The scope of the Planetary Atmospheres activity includes laboratory investigations that supply basic physical measurements that are currently needed to interpret planetary data. These include measurements and calculations of spectroscopic properties, (excitation, dissociation, and ionization cross-sections), optical properties, and thermodynamic properties of materials found in planetary atmospheres. Proposals for analysis of data from NASA missions that return significant amounts of data, which are in the public domain, are encouraged. These include released data from the Galileo, Mars Pathfinder, and Mars Global Surveyor missions.

In all cases, a Planetary Atmospheres investigation should propose to attack a specific problem of the highest intrinsic scientific value. Proposals that serve as an umbrella for a variety of research tasks are not appropriate. Note that atmospheres of extrasolar planets are included within the scope of the Planetary Atmospheres activity, but investigations of the Earth's atmosphere and atmospheres of nonplanetary astrophysical objects are not.

2. Programmatic Information

Proposals are sought for new projects that fall within the scope of the Planetary Atmospheres Program. Presently, about \$7M is budgeted for this program in Fiscal Year 2001, for which this NRA solicits proposals, and approximately 100 investigations are expected to be supported by these funds. Of these, approximately 25 new proposals are expected to be selected through this NRA. Investigations may be proposed for a one, two, or three-year period of performance. For multiyear grants, a progress report should be submitted to the Discipline Scientist at the address below 90 days before the renewal date of the annual agreement. The Project Description should be limited to no more than five single-spaced, typewritten pages and include a brief statement of planned work for the coming year, a report of progress made during the previous year, publications generated by this research, a budget, and an estimate of the amount of previously awarded funds that remain available at the end of the award year. The five page limit does not include a Cover Page, detailed budgetary information, or reprints.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <http://www.lpi.usra.edu/panel> ; proposers without access to the Web or who experience difficulty in using this site may contact the Lunar and Planetary Institute by E-mail at panel@lpi.usra.edu or by phone at (281) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Planetary Atmospheres Program
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Phone number for commercial delivery (281) 486-2166

For further information, contact the Discipline Scientist:

Dr. Denis Bogan
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0359
E-mail: denis.bogan@hq.nasa.gov

A.5.4 Planetary Suborbital Research

1. Scope of Program

The Planetary Suborbital Research program element solicits science investigations, the completion of which involves the flight of instruments as payloads either (i) on suborbital sounding rockets; (ii) on stratospheric balloons; or (iii) on Shuttle-based platforms or the Space Station. The latter type of program will be evaluated on a contingency basis, with no expectation of flight during the funding period covered by this NRA. This NRA is for new development efforts, as well as for ongoing programs. In all cases, proposed investigations must include appropriate plans and resources for the reduction and analysis of the data that are expected to be acquired.

From time to time, opportunities to fly experiments as secondary attached payloads on expendable launch vehicles or on reusable platforms such as Hitchhiker or Spartan become available. Opportunities of this type are unpredictable and usually have significant cost uncertainties. Therefore, these types of flight opportunities are solicited under this NRA on a contingency basis only, with no expectation of funding or flight. Submittal through this NRA allows payloads of this type to be peer reviewed and to provide a ready list of scientifically and technically excellent payloads that could be flown if the opportunity and funding arise. If proposing this type of payload, the proposer should identify the type of platform that would be suitable for the proposed experiment.

In the past, opportunities to propose Planetary Suborbital Research investigations have been announced every three years. Beginning this year, consistent with guidance from the Associate Administrator for Space Science, opportunities will be announced *annually*. It is anticipated that *one* investigation will be selected at each annual opportunity and that the program will support three or four investigations at any given time. Total funding for the Planetary Suborbital Research program element is about \$600,000 per year.

Proposers are encouraged to define investigations that can be accomplished within a three-year period. Proposers may specify shorter periods of performance if a full three-year period is not required to complete an investigation. Investigations that may require support beyond three years will be subject to full competitive review at the end of the initial three-year period. Proposals for such investigations should identify key projected activities that occur after the initial three-year interval.

It is recognized that investigations may evolve with time. Therefore, emphasis should be placed on describing the first year's effort, but with as much detail as possible regarding planned second and third year activities, including the planned flight phase and data analysis. Similarly, a detailed budget supporting the first-year's work is required, together with credible estimates for succeeding years.

Student participation in this Planetary Suborbital Research program element is strongly encouraged, especially if it can be concluded within the nominal tenure of graduate training. Therefore, a brief description of the educational goals and training of such personnel should be included in the proposal. Note that such student participation is not to be confused with the Education and Outreach Program described in Appendix A.10. A brief description of the plans for the reduction, analysis, and archiving of data should also be included in the proposal.

2. Programmatic Information

The number of groups that can be supported to fly sounding rockets (and other forms of flight opportunity) is limited and heavily dependent on the funds available to this program. At present, the program supports two sounding rocket investigations. NASA does not carry reserves to accommodate any cost overrun incurred by a particular investigation. Such a situation may entail either descopeing an initially proposed investigation or delaying or canceling a particular launch date opportunity.

Proposals submitted in response to this NRA may include budgets for up to three years. These budgets are expected to cover complete suborbital investigations, including payload development and construction, instrument calibration, launch phase, and data analysis. The proposals selected will be funded on a yearly basis. Yearly funding allotments to complete a period of performance after the first year require an Annual Progress Report, which should include a summary sufficient to demonstrate that satisfactory progress has been made, and an updated budget.

NOTE: Appendix C of the ROSS-00 NRA contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

Owing to the larger scope and complexity of Planetary Suborbital proposals, the page limit for the *Science/Technical/Management Section* given in Section C.5.2 of Appendix C is revised to 20 pages instead of the default 15 pages.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the summary cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <http://www.lpi.usra.edu/panel> Proposers without access to the Web or who experience difficulty in using this site may contact the Lunar and Planetary Institute by E-mail at panel@lpi.usra.edu or by phone at (281) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement

Planetary Suborbital Research Program

The Lunar and Planetary Institute

3600 Bay Area Boulevard

Houston, TX 77058

Phone number for commercial delivery (281) 486-2166

Additional information can be obtained from the Discipline Scientist:

Dr. Jay T. Bergstralh

Research Program Management Division

Code SR

Office of Space Science

NASA Headquarters

Washington, DC 20546-0001

Telephone: (202) 358-0313

E-mail: jay.bergstralh@hq.nasa.gov

A.6.1 Exobiology

1. Scope of Program

The goal of NASA's Exobiology Program is to understand the origin, evolution, and distribution of life in the universe. Research is centered around the origin of life and is focused on achieving this goal by tracing the pathways taken by the biogenic elements, leading from the origin of the universe through the major epochs in the evolution of living systems and their precursors. These epochs (and the approximate percentage of funding historically allocated to each) are: the cosmic evolution of the biogenic compounds (15%); prebiotic evolution (35%); the early evolution of life (35%); and the evolution of advanced life (15%). The areas of research emphasis in this program are as follows:

- *Cosmic Evolution of the Biogenic Compounds*

The principal goal of research in the area of the cosmic evolution of the biogenic compounds is to determine the history of the biogenic elements (C, H, N, O, P, S) from their birth in stars to their incorporation into planetary bodies. Emphasis is placed on studies that constrain or extend concepts of possible chemical evolution relevant to the origin, evolution, and distribution of life.

- *Pre Biotic Evolution*

Research in the area of prebiotic evolution seeks to understand the pathways and processes leading from the origin of a planet to the origin of life. The strategy is to investigate the planetary and molecular processes that set the physical and chemical conditions within which living systems arose. Four major objectives are to: i) determine constraints on prebiotic evolution imposed by the physical and chemical histories of planets; ii) develop models of active boundary regions in which chemical evolution could have occurred; iii) determine what chemical systems could have served as precursors of metabolic and replicating systems both on Earth and elsewhere; and iv) determine in what forms prebiotic organic matter has been preserved in planetary materials.

- *Early Evolution of Life*

The goal of research into the early evolution of life is to determine the nature of the most primitive organisms, the environment in which they evolved, and the way in which they influenced that environment. As an approach to understanding life in the universe, the opportunity is taken to investigate two natural repositories of evolutionary history available on Earth, in particular, the molecular record in living organisms and the geological record in rocks. These paired records are used to: i) determine when and in

what setting life first appeared; ii) determine the characteristics of the first successful living organisms; iii) understand the phylogeny and physiology of microorganisms whose characteristics may reflect the nature of primitive environments; iv) determine the original nature of biotic energy transduction, membrane function, and information processing through study of extant microbes; and iv) elucidate the physical, chemical, and biotic forces operating on microbial evolution.

- *Evolution of Advanced Life*

The research associated with the study of the evolution of advanced life seeks to determine the extrinsic factors influencing the development of advanced life and its potential distribution. This research includes an evaluation of the influence of extraterrestrial and planetary processes on the appearance and evolution of multicellular life, conducted by: i) tracing the effects of major changes in the Earth's environment on the evolution of complex life, especially during mass extinction events, and ii) determining the effects of global events and of events originating in space on the production of environmental changes that affected the evolution of multicellular life. Also, studies will be considered that seek approaches to investigations furthering our understanding of the distribution of life elsewhere in the universe. Note that an Evolutionary Biology NRA that will focus on the process of evolution and the future of life on Earth and in space is planned.

- *Planetary Protection Research*

There are numerous areas of research in exobiology that also have implications with respect to preventing the contamination of extraterrestrial environments by terrestrial organisms carried by spacecraft and for understanding the potential survival of extraterrestrial organisms that may be returned to Earth. Research is required in order to allow NASA to understand the potential for contamination and to set standards in these areas for spacecraft preparation and operating procedures and for returned-sample analysis. Many of these research requirements derive directly from recent National Research Council reports on planetary protection requirements for solar system exploration missions (see the on-line reports and list of publications at the [National Academy Press at http://www.nap.edu/](http://www.nap.edu/)).

Therefore, this ROSS-2000 NRA is also soliciting exobiology research pertinent to planetary protection goals in the following areas:

1. The use of modern molecular analytical methods to detect and classify the widest possible spectrum of Earth microbes on spacecraft surfaces during assembly and launch processing, as well as the development of new methods for the same purposes;
2. Procedures for detection, preliminary characterization, and containment of organisms (living, dead, or fossil) in returned samples;

3. Procedures for sample sterilization which largely preserve sample information; and
4. The limits of life, including the potential for organisms to originate and thrive on bodies such as Europa, Ganymede, Callisto, Phobos, Deimos, P-type asteroids, D-type asteroids, C-type asteroids, undifferentiated metamorphosed asteroids, differentiated asteroids, and/or comets.

- *Instrumentation*

Included in the scope of the Exobiology Program is the development of advanced instrument concepts and technologies that may enable exobiology research in space exploration. The severe constraints of weight and volume on payloads and the unique nature of some potential exobiological investigations necessitates novel concepts for flight instrumentation to maximize the scientific return of future missions. Note: Beyond advanced instrument concepts, the Planetary Instrument Definition and Development Program supports the development of exobiology instruments through the breadboard stage (see Appendix A.6.2 below).

2. Programmatic Information

Proposals are sought for new projects within the scope of the Exobiology Program. Proposals submitted in response to this NRA should be for work that is not currently supported by the Exobiology Program, as well as tasks that are currently funded in the Exobiology Program but whose periods of performance are expiring in 2000 or in the first half of 2001. Periods of performance from one to five years (typically three years) may be proposed as appropriate to the nature of the contemplated research. Proposers are reminded that programmatic balance (see historical percentages above) may limit the opportunities for funding in some areas. Also note that NASA procurement regulations require that any task accepted for a period of performance longer than three years requires the submission of a complete proposal for review at the end of the first three years.

The Exobiology Program usually competes one-third of the program every year and so anticipates that approximately \$3M will be available to support research proposed in response to this NRA.

Funds are available under the Planetary Major Equipment Program (Program Element A.6.3 in this NRA) to provide for upgrading of analytical instruments required by investigations sponsored by the Exobiology Program. New, major analytical instrumentation that is necessary for the conduct of proposed research, or that would substantially improve its quality, should be identified and requested in a special section of each proposal, to be titled "Major Equipment Request." Details of specific guidelines, restrictions, and exclusions are provided in the Planetary Major Equipment Program section of this NRA.

Progress reports for funding the second or subsequent years of research, for previously approved multiple year awards, will be considered separately and should be sent directly to the Exobiology Program Scientist at least 90 days before their funding anniversary date.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

A Notice of Intent is requested for this program element. The schedules for submission of the Notice of Intent and proposal are given in Appendix A. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5) is <http://www.lpi.usra.edu/panel> ; proposers without access to the Web or who experience difficulty in using this site may contact the Lunar Planetary Institute by E-mail at panel@lpi.usra.edu or by phone at (281) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Research in Exobiology
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Phone number for commercial delivery: (281) 486-2166

Obtain additional information from:

Dr. Michael A. Meyer
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0307
Facsimile: (202) 358-3097
E-mail: michael.meyer@hq.nasa.gov

A.6.2 Planetary Instrument Definition and Development Program

1. Scope of Program

The Planetary Instrument Definition and Development Program (PIDDP) supports the advancement of spacecraft-based instrument technology that shows promise for use in scientific investigations on future planetary missions. The goal of the program is not to develop flight-qualified hardware, but rather to define and develop scientific instruments or components of such instruments to the point where the instruments may be proposed in response to future announcements of flight opportunity without additional extensive technology development. The proposed instrument technology must address specific scientific objectives of candidate future missions. New measurement concepts can be proposed, as well as methods to significantly improve the performance of existing instruments and/or the development of technologies that enable integrated instrument packaging (architectures). The emphasis in this NRA is also on the development of miniaturized, low power, low cost instruments for Discovery-class and other similar missions.

Instrument definition and development studies can take place at several stages, from feasibility studies, to conceptual design, to laboratory breadboarding (but not brassboarding) of critical components and complete instruments. Particularly for immature or very complex new instruments, proposers initially may choose to only define or develop the most risky components. However, in all cases of component only development, one or more likely scenarios for possible follow on instrument development should be described. For all (instrument or component) proposals, scientific objectives of those instruments (or proposed follow on instruments), and future candidate missions should be discussed in the proposal. Proposed instruments must address significant scientific questions relevant to stated NASA goals.

Results of PIDDP work have contributed to the eventual development of flight hardware flown on or selected for many NASA missions. Since this is the goal of the PIDDP program, proposals should consider the potential of the proposed effort for enhancing future technology validation and science missions. This NRA also solicits proposals for instrument concepts addressing goals of NASA's Astrobiology Program. Spacecraft instrument development activities that were previously funded under the Exobiology Research and Analysis Program are now included exclusively in the PIDDP.

Proposals not appropriate for this NRA are those that seek to develop laboratory instruments, ground-based or airborne telescopes, auxiliary instrumentation such as spectrometers for telescopes, onboard data processing or data compression studies, or any spacecraft technology that does not directly address science instrumentation.

While this program element will be advertised annually, the nature of specific efforts selected for funding will vary, *with emphasis in any given year placed on preparation for the nearest term missions for which instruments have not yet been selected.* However, there can also be support provided for long lead-time definition studies, for innovative approaches that may provide entirely new classes of instruments, for the development of new enabling technology for missions farther in the future, and/or for detector development studies that may advance the technology for a wide range of planetary instrumentation applications. Therefore, proposers are encouraged to relate their proposed efforts as closely as possible to specific future planetary missions and demonstrate how their technology addresses the scientific goals of these missions.

2. PIDDP-Focused Future Missions

Proposals for instrument definition and development for certain of the following future missions will be considered for funding through the PIDDP.

- *Discovery Program*

The Discovery Program is envisaged as a series of focused, quick-turnaround missions. Development time will be approximately 36 months. Solicitations occur approximately every 18-24 months.

The Discovery missions may include flybys, orbiters, landers, airplanes, balloons, Earth orbiting telescopes, and sample return missions to a variety of solar system objects to study surface and atmospheric composition, thermal structure, meteorology, geoscience, topography, dynamics, and field and particle environments. Instrumentation and techniques addressing critical scientific questions in this broad range are appropriate development efforts under the PIDDP. Technology applicable to multiple missions and investigations will have higher priority for funding. Proposals for the development of new instruments for missions already selected for flight or selected for Discovery Phase A study and/or development will not be accepted under this NRA.

- *Mars Surveyor Missions*

The Mars Surveyor missions include orbiters and landers that utilize small to medium spacecraft. For upcoming missions, U.S. science instruments for the Mars Surveyor 2001 orbiter and lander missions and for the Mars Surveyor 2003 missions have already been selected. Future launches to Mars will occur approximately every 26 months. Scientific payloads will consist of small, lightweight, low power consumption instruments.

Instrument development proposals for both U.S. and international follow-on missions to Mars (i.e., beyond the Mars 2003 mission) are appropriate under this NRA. Consideration will also be given to proposals addressing the development of instrumentation for Mars sample return missions, a major focus of Mars exploration in 2003 and beyond. Instrument technologies for the *in situ* exploration of Mars are of particular interest for future missions. The PIDDP seeks new concepts for Mars surface science, including, but not limited to, potential instruments for radiometric age-dating, soil/rock mineralogy and chemistry, water/ice detection and characterization, exobiology assessment, drilling/coring, and atmospheric analyses. Some, but not all of these, are truly new and complex instrument concepts for planetary exploration. As such, proposers may choose to initially pursue only development of the most challenging components, as long as discussion of their connection to possible future instruments and scientific objectives is clearly discussed.

- *Micromissions*

At the time of the writing of this NRA, NASA anticipates opportunities in the coming years for micromissions. These micromissions could target Mars or other inner Solar System bodies, and possibly outer Solar System bodies. *Total* science payloads will be very small in mass (estimated 5 to 30 kg depending strongly on type of mission, e.g., flyby, orbiter, or lander, and the object to be visited; the lower bound is more likely than the upper bound), as well as power and volume. Instrument definition and development relevant to these possible micromissions is considered appropriate for this PIDDP NRA.

- *Outer Solar System Missions*

Missions to the outer planets and satellites are a specific NASA objective. By the time of selection of the proposals called for under this NRA, instruments will have already been selected for a Europa Orbiter mission and a Pluto/Kuiper Express mission, so instruments for these specific missions are not appropriate under this NRA. Future mission opportunities might include a Europa lander, a Titan explorer, a comet nucleus sample return, and/or a Neptune Orbiter, as well as focused science missions under the Discovery Program. Therefore, the PIDDP solicits instrument concepts relevant to these types of possible future outer planet missions, although proposers are reminded that emphasis in any PIDDP selection will be placed on preparation for the nearest term missions for which instruments have not yet been selected. Outer planet instrument concepts include, but are not limited to, atmospheric entry probe instrument concepts (e.g., for Titan), science instruments relevant to comet nucleus sample return, *in situ* instruments for icy bodies, particularly Europa, including near surface chemical and related exobiological analyses, geophysical analyses (e.g., seismic and heat flow), shallow (~10 cm) sampling techniques,

and lightweight imaging systems with broad spectral range. As stated previously, because of the newness and complexity of some of these techniques, particularly under Europa or Titan-like conditions, proposers may choose initially only to define or develop the most challenging or unknown components, but connections to possible instrument follow-on's and science objectives must be discussed.

- *Origins of Solar Systems*

NASA's long-range strategy includes flight missions that will follow and extend the ground-based phase of the search for planets about other stars and several approaches for space-based platforms addressing the search for extrasolar planetary systems have been identified. Breadboard studies of technologies and instruments (consistent with the limited scope of the PIDDP) that could contribute to the space-based search for extrasolar planets are appropriate for this NRA.

3. Programmatic Considerations

Proposals are solicited under this NRA for instrument definition and development only for the missions or classes of missions described in Section 2 above. Therefore, all proposals submitted to PIDDP must specify:

- The mission or class of missions for which the proposed instrument is applicable. Instruments that might fly on a number of missions will be given priority over those applicable to only a single mission.
- The science objectives of the proposed instrument. The relationship between the science objectives and the instrumental capabilities must be clearly demonstrated. For those instruments applicable to many missions or capable of meeting multiple science objectives, examples of science objectives for the proposed mission or missions should be given.
- Technological advances to be pursued as an inherent element of achieving the science objectives. Proposers are also asked to identify potential mechanisms that could facilitate transfer of these technologies to other users, including the private sector, for possible application beyond the immediate one of meeting mission science objectives.

It is anticipated that the scientific payloads on all future solar system exploration missions will be limited to small, low mass, low power consumption, and low cost instruments. For this reason, only proposals for instrument definition and development satisfying these general specifications will be considered for support.

The evaluation criteria in Section 1.4 of Appendix C are fully applicable to the PIDDP, including evaluation of scientific and technical merit, uniqueness and innovation, team and institutional capabilities, and cost. In addition, however, the determination of a proposal's relevance shall also take into account the following factors:

- The extent to which the proposed instrument is applicable to multiple missions in the Exploration of the Solar System science theme and/or Origins of Solar System program element (see Section 2);
- The extent to which the instrument addresses a priority science goal of the mission or missions for which it would be a candidate for flight;
- Either the near-term nature of the mission or missions in question, or the necessity of embarking on a long lead-time development of a very important instrument contemplated for flight on a mission that is of high priority, even though it is not in the near-term queue; and
- Whether the instrument is deemed to fall within the scope of PIDDP, including whether it too developmentally mature for PIDDP.

It should be noted that the contemplated sequence of missions described in this NRA is a best current estimate and is subject to change. NASA reserves the right to make a determination of relevance based on the contemplated sequence of missions as it is understood at the time of proposal evaluation and selection.

4. Proposal Submission

Full, new proposals are sought for either entirely new studies or for the extension of PIDDP studies terminating in FY 2000. Proposals may specify periods of performance of up to three years. A final report will be required at the termination of the period of performance. It is expected that there will be approximately \$2.5M dollars available for new (and extension) proposals, and that 11 to 16 studies will be supported with these funds.

As a modification to the default specification in the summary cover letter of this NRA , 17 copies of the proposal are required, including one with original signatures.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5) is TBD*. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement
Planetary Instrument Definition and Development Program
TBD*

*TBD: see SPECIAL NOTE (3) in the summary cover letter of this NRA.

Proposals previously selected for multiple year periods of performance that are continuing beyond FY 2000 require the submission of an Annual Progress Report and updated budget in order to allow processing of their annual funding allotment. Two copies should be sent to the Discipline Scientist listed below at least 90 days prior to the anniversary date of the funding instrument.

Additional information may be obtained from the Discipline Scientist:

Dr. Bruce Betts
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0297
E-mail: bruce.betts@hq.nasa.gov

A.6.3 Planetary Major Equipment Program

1. Scope of Program

This program element allows proposals for upgrading the analytical, computational, telescopic, and other instrumentation required by investigations sponsored by the Solar System Exploration programs, including Exobiology. New major instrumentation that is necessary for the conduct and/or quality of proposed research or that would significantly benefit the broad science community, may also be proposed. Major Equipment proposals may be submitted in conjunction with new scientific research proposals, or as an augmentation to existing multiple year proposals that are currently funded through OSS, for support of the Solar System Exploration science theme or Exobiology program element. A Major Equipment proposal that is not affiliated with such a “parent” OSS research proposal will not be considered.

It is estimated that \$1M will be available through this program element to support approximately 20 grants. In order to make the best possible use of the funds that may be available, proposers who request funds for Major Equipment are encouraged to seek cost sharing where appropriate and to propose collective use where that is reasonable, i.e., instruments that could be made available for use by other qualified members of the planetary science community. Cost-shared proposals are encouraged for very high cost instruments; the partners of such proposals must provide a written statement regarding long term funding and/or institutional commitments.

However, proposers need to recognize that NASA interprets cost-sharing arrangements as joint ownership, and, therefore, NASA has the option to retain title to instruments acquired under such arrangements. Issues of ownership and title may be especially complicated under arrangements that involve other Federal agencies (e.g., the National Science Foundation). When joint ownership cannot be avoided, and the requested NASA contribution will exceed \$1000, agreement regarding NASA’s retention of its option to take title, and the conditions under which the option (if retained) will be exercised, shall be reached and documented prior to purchase.

2. Exclusions and Restrictions

- Instrumentation or support equipment costing less than approximately \$20K is not considered major; requests for such items should be included in the body of the research proposal submitted to the appropriate Solar System Exploration program element in appendix A.5 of this ROSS-00 NRA.

- Instrumentation or equipment considered inappropriate for this Major Equipment program element includes personal computers or computer peripherals (unless these are integral parts of the instrumentation requested), miscellaneous support equipment, support contracts, and equipment repair where the repair does not involve significant enhancement of the instrument's basic capabilities, nor should funds be sought to support maintenance and continued operations of any instrument requested.
- In no event will proposals be considered that seek to design, develop, test, or evaluate new instruments that are to be considered for sale.

3. Proposal Requirements

Format. A proposal for major equipment should be written so that it can be reviewed as a stand-alone proposal, although it will be reviewed in connection with the appropriate “parent” science proposal or existing multiple year award. This is especially important for proposers who are operating under awards and who normally would submit only a progress report to request an additional funding allotment to complete a period of performance and because Major Equipment requests may also be reviewed by a multidisciplinary group external to the normal review process. Therefore, all such proposals should contain a short abstract and sections on project description, management, and costs.

Objectives. Types and/or classes of instruments that are considered appropriate to be proposed for this program element are listed below, although requests for instruments not specifically identified in the list will receive equal consideration. Note that this list is not inclusive, but rather illustrative of the range of instrument types that are appropriate:

- Solid source, light element, and noble gas mass spectrometers
- Electron microprobe
- Scanning electron microscope
- Transmission electron microscope
- Camera-class ion microprobe
- Activation analysis equipment
- X-ray fluorescence analyzer
- Organic analysis instrumentation
- Static high pressure instrumentation
- Portable high-speed charge-coupled device for occultation measurements
- Telescopic instrumentation
- High resolution infrared spectrometer
- Large format optical charge-coupled device (2000 x 2000 pixels) with coronagraph
- Faint object infrared spectrometer
- Near infrared array camera with coronagraph
- Coolable white cells

- Instrumentation for planetary atmospheres laboratory studies
- Tunable dye-laser high resolution spectrometer
- Instrumentation for measurement of gas phase reaction rates, photochemical reaction rates and branching rates, and collisional, disassociation, ionization, or recombination cross-sections.

Project Description. The main body of the proposal should first identify the instrument to be acquired or developed and the type of use proposed. It should contain a strong justification, including a description of why the instrument is necessary for the investigator's research or how it would enhance that research, citing specific examples wherever possible. It should also demonstrate why the enhanced capability is important to planetary science in general. If an instrument is proposed for the benefit of the science community, the justification should emphasize how the enhanced capability would benefit the larger planetary science community. All justifications should address how the requested instrument relates to existing capabilities, both in the investigator's own as well as other facilities.

Any substantial collaboration with individuals not referred to in the budget, or use of consultants, should be described. Any anticipated cost-sharing or substantial institutional contributions should be described. It should be noted that cost sharing (between NASA and other agencies such as the Department of Energy or the National Science Foundation) is encouraged to the extent that NASA's share of the cost will ensure adequate use by NASA investigators. This aspect of any proposed cost-sharing acquisition must be discussed in the proposal. If other agencies have been approached or have made tentative commitments, the proposal should document that and provide names and telephone numbers of appropriate officers in those agencies who can discuss their agencies' interest.

When it is expected that the acquisition or development of an instrument or facility will require more than one year, the proposal should cover the complete project but with a clear distinction between the efforts involved in each requested year.

Instrument Management and User Access. In addition to use by the Principal Investigator, if the proposed instrumentation is intended to be offered for use by the scientific community at large, a section is required that describes how the requested instrument would be managed. This description should include a statement of the percentage of the instrument's time that would be available to other users and a general statement regarding aspects of user access, such as time of day when access would be granted, whether access would be "hands on" or only by an operator or collaborator in the PI's group, any costs to be charged for use and how costing would be handled, and how users would apply to gain access (personal communication, formal proposal, etc.).

Requests for an instrument should specify how the instrument is to be used, whether by Principal Investigator (PI) and the PI research group only, or by the PI group as well as other investigators (facility instrument). These categories are defined below.

Investigator Instrument. An investigator instrument is an instrument acquired or developed by an investigator to support his or her research where he or she has full authority for its exclusive use and where there are no commitments to make the instrument available to other investigators.

Investigator Facility Instrument. An investigator facility instrument is an instrument acquired or developed by an investigator to support his or her research where an identified portion of its time is to be reserved for use by the PI but where an additional, specified portion of its time will be made available to other knowledgeable NASA planetary program investigators, and where all details of access, method of use, charging, and data rights are determined by the PI in negotiation with potential users.

Regional Facility Instrument. A regional facility instrument is an instrument of considerable cost or one that is limited to one location by virtue of its use on a specific beam source or telescope facility, but is acquired by a PI to support his or her research. A significant, specified portion of a regional facility instrument's time will be reserved for use by the PI, but a significant, specified portion of its time must also be available to other planetary program investigators. Unlike an investigator facility instrument, however, all details of access, announcement of availability, assistance to be provided on its use and methods of use (whether hands on or by an operator), charges, and data rights must be documented and agreed to by NASA and the sponsoring institution before NASA support is provided.

Costs. If the proposed instrument is to be acquired from commercial sources, only those costs directly associated with the acquisition, installation, and check-out of the instrument should be requested. Costs for maintenance or operation beyond the check-out period should not be included but instead must be requested in research proposals submitted to the appropriate discipline programs. If the instrument is to be developed by the investigator, all costs associated with the development and final check-out should be requested. Multiple year requests would be expected in these cases. In all cases, however, provision of an adequately documented cost section will facilitate evaluation, and, if selected, improve the likelihood of a timely award. It is especially important that each relevant cost category (see details in Section C.5.3 of Appendix C) should be fully explained and substantiated.

4. Programmatic Considerations

Evaluation factors will be those employed in evaluation of proposals received in response to this NRA, given in Section C.1.4 of Appendix C with the following additions:

- In considering the relevance of the Major Equipment request to NASA's planetary and exobiology sciences objectives, attention will be focused on the added value that would be gained by the addition of the instrument capability to ongoing and anticipated research of the proposer, in particular, and to NASA's objectives in general.
- In evaluating the intrinsic merit of the request, additional factors that will be considered of equal weight are the scientific merit of the original proposal to which the request is tied and the value that the new or enhanced capability would add to science and/or education beyond that offered specifically to planetary science.

Major Equipment proposals will be reviewed by the relevant discipline peer review panel during the full proposal review and in the context of its "parent" research proposal. Those requests that most clearly meet the criteria outlined in terms of scientific merit, program balance, and funding as judged by the peer panels will be considered by the OSS Discipline Scientist on the basis of programmatic merit. Funding recommendations are then referred to the Director, Research Program Management Division for final selection.

All requests selected for Major Equipment support will be funded through augmentation to the "parent" grant/contract for the basic research program. If such a request involves a multiple year period of performance for its development activities, an annual funding allotment to the basic continuing award will be provided only upon receipt, review, and approval of an Annual Progress Report and updated budget and/or statement of work as may be appropriate.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.2 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

As noted in Section 1 of this Program Element, a Major Equipment proposal is to be submitted only in conjunction with a new scientific research proposal, or as an augmentation to an existing multiple year investigation currently funded in support of the OSS Solar System Exploration science theme. Therefore, the schedules for submission of Major Equipment NOI's and proposals are the same as those given in Table 1 of the cover letter of this NRA for the relevant Solar System Exploration program elements.

The World Wide Web site for submitting both the NOI and proposal *Cover Page/Proposal Summary* (see Appendix C.5.3) is <http://www.lpi.usra.edu/panel> ; proposers without access to the Web or who experience difficulty in using this site may contact 281-486-2137 or panel@lpi.usra.edu for assistance. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement

Planetary Major Equipment Program

Lunar and Planetary Institute

3600 Bay Area Boulevard

Houston, TX 77058

Phone number for commercial delivery: 281-486-2166

Additional information about this Major Equipment program element may be obtained from the respective Discipline Scientists for the program elements in Appendix A.5 of this NRA to which the “parent” scientific research proposal is being submitted, or who is cognizant for an existing multiple year award for which a Major Equipment supplement is proposed.

A.7 SPACE ASTROPHYSICS RESEARCH AND ANALYSIS

1. Scope of Program

The Space Astrophysics Research and Analysis (SARA) program solicits basic research proposals for investigations that are relevant to NASA's programs in astronomy and astrophysics in the wavelength regime greater than approximately 100 Å through the radio spectrum (Laboratory Astrophysics is exempt from wavelength restrictions, as noted below). There are four primary goals: (i) to develop detectors which represent the best possible state-of-the-art detector technology for instruments that may be proposed as candidate experiments for future space flight opportunities; (ii) to develop science investigations, whose completion involves the flight of instruments as payloads on suborbital sounding rockets, stratospheric balloons, or long duration suborbital platforms (iii) to develop supporting technology, perform laboratory research, and conduct ground based observations (see below for restrictions) which are directly applicable to space astrophysics missions; and (iv) to investigate topics in general relativistic and gravitational astrophysics (i.e., tests of the fundamental laws of physics as they are relevant to astrophysics and cosmology). While excellence of proposed research is the primary selection criterion, relevance to NASA missions is a necessary criterion and must be explicitly described in the proposal. Lists of past, present, and future missions of interest are given in Tables I and II below, which are furnished only as a guide to assessing relevance of proposals for this Program Element.

Note that as in ROSS 99 the Laboratory Astrophysics component of the SARA program includes theoretical investigations in the area of "Atomic and Molecular Astrophysics," while compilation of large data bases of parameters should be directed to the Applied Information Systems Research Program (described in Appendix A.9). Proposals for ground-based observations will be considered only if: they are in direct support of NASA space astrophysics goals, and the proposers are ineligible, by virtue of their institutional affiliation, to receive direct support from the National Science Foundation for ground-based astronomy.

Topics of interest to this SARA program fall into the following six research categories, which are listed in order of their funding priority:

- *Detector development* – see below for details;
- *Suborbital* – described above ;
- *Supporting technology studies (longward of 100 Å)* - for example, ultra-light holographic/diffraction grating development, thin films, lightweight composite mirrors, spectrometers, interferometers, infrared cameras;
- *Laboratory astrophysics (theoretical or experimental for all wavelengths)* - for example, pre dissociation in diatomic molecules, electron-ion collisions, compilation of transition probability data, measurement of absolute oscillator strengths, spectroscopic studies of PAH's, investigation of carbon clusters, computation of atomic or molecular parameters;
- *General relativity and physics of gravitation* - for example, lunar-laser ranging tests of relativity, solar-system tests of gravitational theories using satellite data, low frequency gravitational wave astronomy; and
- *Ground-based astronomy (longward of 100 Å)* - for example, calibration of supergiants for Hubble Space Telescope, development of instrumental or observing techniques.

- *Detector Development Program*

The intent of detector development research solicited here is to understand the fundamental operational aspects of detectors and to develop them to the point where they can be proposed as part of an instrument for future announcements of flight opportunity. Although any detector technology may be proposed to this opportunity, the Next Generation Space Telescope (NGST) project is currently actively supporting detector programs for that mission. Thus, proposals in response to this current NRA would be given a lower priority for developing detectors specifically to achieve NGST detector sensitivity or performance goals.

Considering currently available technology for detectors for space astronomy, the greatest emphasis of this solicitation will be towards those developmental efforts that address the technological problems associated with achieving some of the following desirable detector attributes (not in priority order):

- Increasing quantum efficiency;
- Increasing the array format size;
- Increasing the spatial resolution;
- Increasing the dynamic range (including individual detector elements, as well as the collective response of the detector);
- High speed, high resolution, low noise read-out techniques;
- Reduced detector noise;

- Fabrication and formatting techniques;
- Extending wavelength coverage (e.g., operation of submillimeter and radio receivers at high frequency, increasing instantaneous bandwidth, extending mid-IR detectors to operate either passively or cooled at longer wavelengths, or near-IR detectors to shorter wavelengths); and/or
- Resistance to effects of operation in space.

Since the environment and constraints of space flight are far stricter than those for ground-based applications, research groups considering development of space detectors must be cognizant of the following characteristics that are highly desirable in reliable, space-quality detection systems: low mass, low sensitivity to particle radiation (“radiation hardness”), low power consumption, compactness, ability to operate in an “open face” mode for sensitivity at wavelengths shorter than 1100 \AA , designed for operation in a vacuum (such that high voltage arcing is minimized), vibration tolerance, and ease of remote operation, including reduced transient effects and ease of calibration. New measurement concepts may be proposed, as well as methods to improve the performance of existing detectors. Research into the basic properties of detector systems that could be considered for use in space is also strongly encouraged. It is not, however, the purpose of this solicitation to support development of detectors that are primarily suitable for ground-based astronomy. Observing with ground-based facilities outside the laboratory for newly-developed detectors may be necessary to verify detector or overall system performance as an integral part of a detector development program, and this case must be made clear in the proposal.

Proposers are asked to identify potential mechanisms which could facilitate transfer of these detector technologies to other users, including the private sector, for possible application beyond the immediate detector development goals.

Table I - Past, Current, and Future NASA Missions Having Objectives in Infrared, Submillimeter, and Radio Astrophysics

(Note: Mission information is available on-line at the [OSS Space Science Missions page](http://spacescience.nasa.gov/missions/index.htm) <http://spacescience.nasa.gov/missions/index.htm>)

<u>MISSION</u>	<u>LAUNCH YEAR</u>	<u>REMARKS</u>
• Infrared Astronomical Satellite (IRAS)	1983	Ceased operation
• Cosmic Background Explorer (COBE)	1989	Ceased operation
• Hubble Space Telescope (HST)	1990	In operation.
• <i>Near Infrared Camera and Multi-object Spectrometer (NICMOS)</i>		Reactivated 2001
• Infrared Space Observatory (ISO)	1995	Terminated in 1998.
• Space Very Long Baseline Interferometry 1996 (HALCA)		In operation
• Submillimeter Wave Astronomy Satellite (SWAS)	1998	In operation
• Space Infrared Telescope Facility (SIRTF)	2001	Great Observatory
• Stratospheric Observatory for Infrared Astronomy (SOFIA)	2002	Multipurpose Observatory
• Next Generation Space Telescope (NGST)	2007	Study of the Universe at high red shift
• Microwave Anisotropy Probe (MAP)	2000	CMBR
• Far Infrared Space Telescope (FIRST)	2007	
• PLANCK	2007	CMBR
• Terrestrial Planet Finder	TBD	

Table II - Past, Current, and Future NASA Missions Having Objectives for UV, Visible, and Gravitational Astrophysics

<u>MISSION</u>	<u>LAUNCH YEAR</u>	<u>REMARKS</u>
• International Ultraviolet Explorer (IUE) 1200–3200Å	1978	Terminated in 1996.
• Hipparcos	1989	ESA astrometry mission.
• Hubble Space Telescope (HST) <i>Goddard High Resolution Spectrograph (GHRS)</i> 1150–8000Å <i>Faint Object Camera (FOC)</i> 1150–6500Å <i>Faint Object Spectrograph (FOS)</i> 1050–3200Å <i>Wide Field/Planetary Camera 2 (WF/PC2)</i> 1150–11000Å <i>Space Telescope Imaging Spectrograph (STIS)</i> 1150–11000Å	1990	In operation. Ceased operation. Ceased operation. Ceased operation. In operation. In operation.
• Astro-1	1990	Completed 9 day mission.
• Astro-2 400 – 3000 Å	1995	Completed 16 day mission.
• Extreme Ultraviolet Explorer (EUVE) 80–800Å	1992	In operation, Guest Observer program.
• Orbiting and Retrievable Far and Extreme <i>Ultraviolet Spectrometer (ORFEUS)/</i> <i>Interstellar Medium Absorption Profile</i> <i>Spectrograph (IMAPS)</i> 400–1200Å	1993	Completed 5 day mission.
• ORFEUS II / IMAPS	1996	Completed 13 day mission.
• On-going tests of relativity	—	Various current interplanetary spacecraft.
• Far Ultraviolet Spectroscopic Explorer (FUSE) 800–1200Å	1999	3 year mission.
• HST Advanced Camera for Surveys (ACS)	2001	HST replacement instrument.
• Gravity Probe-B (GP-B) - Lense Thirring Effect	2001	2 year mission.
• The Galaxy Evolution Explorer (GALEX) 1350 – 3000Å	2001	28 month mission.
• The Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) 90 – 260Å	2001	12 month mission.
• Cosmic Origins Spectrograph (COS)	2003	HST replacement instrument.
• Full-Sky Astrometric Mapping Explorer(FAME)	2004	30 month mission.
• Space Interferometry Mission (SIM)	TBD	Selected for study.

2. Programmatic Information

It is expected that roughly \$3M will be available through the ROSS-2000 NRA for the funding in FY 2001 of new projects amongst the six categories: detector development, suborbital, supporting technology, laboratory astrophysics, gravitation and general relativity, and ground-based astronomy. Investigators may propose programs of any size for funding extending up to three years under this solicitation. The actual amount of funding awarded to a particular program will be determined by the merit of the program and programmatic goals of the Office of Space Science. Note that funding awards will range from one to three years duration.

In FY 2000, twelve investigations are being funded for suborbital research for a total of \$4.05M, twenty two for detector development for a total of \$4.1M, and sixty-four in the remaining four categories for a total of \$4.7M.

While it is recommended that programs proposed span a three year period, funding limitations may only enable awards of one or two year duration. It is recognized that the proposed investigation may evolve with time. Accordingly, emphasis should be placed upon the first year's effort, with as much detail as possible on any planned second and third year's activities. Proposals for investigations requiring less than a three-year time scale to complete are encouraged, as are those which require a longer time scale to complete, though the latter must undergo subsequent peer reviews every three years. Key projected milestones and accomplishments during each period of the proposed effort should be identified. The proposals selected will be funded on a yearly basis. For multiyear awards, yearly funding allotments to complete a period of performance after the first year require an Annual Progress Report, which should include a summary sufficient to demonstrate that satisfactory progress has been made.

For the **suborbital** program, budgets are expected to cover complete suborbital investigations, including payload development and construction, instrument calibration, launch phase, and data analysis. A brief description of the plans for the reduction and analysis of data should be included in the proposal. One goal of the suborbital program is to maintain the continuity of both instrumental expertise and laboratory facilities of research groups specializing in the fields of experimental astrophysics. Hence, the number of groups that can be supported to fly sounding rockets (and other forms of flight opportunity) is limited and heavily dependent on the funds available to this program. NASA does not carry reserves to accommodate any cost overrun incurred by a particular investigation. Such a situation may entail either descopeing the initially proposed investigation or delaying or canceling a particular launch date opportunity.

During the next decade, NASA and the European Space Agency (ESA) expect to launch satellites to explore, in detail, the cosmic microwave background (CMBR). Consequently, individuals proposing CMBR investigations should endeavor to complete their program within three to five years.

If at all possible, student participation in the **detector development** program and the **suborbital** program is strongly encouraged, especially if it can be concluded within the nominal tenure of graduate training. Therefore, brief details of the educational goals and training of such personnel should be included in the proposal. Note that such student participation is not to be confused with the Education and Public Outreach Program described in section A.10.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.2 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent (NOI) and proposals are given in Table 1 of the cover letter of this NRA. The Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is TBD*. Hard copies of the proposals are to be sent to:

ROSS-2000 NASA Research Announcement
Space Astrophysics Research and Analysis Program
TBD*

*TBD: see SPECIAL NOTE (3) in the summary cover letter of this NRA.

Additional information may be obtained from the following Discipline Scientists:

Dr. Hashima Hasan
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0692
E-mail: hashima.hasan@hq.nasa.gov

Dr. Guy Stringfellow
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0311
E-mail: guy.stringfellow@hq.nasa.gov

A.8.1 X-Ray and Gamma-Ray Astrophysics

The X-Ray and Gamma-Ray Astrophysics program provides support for basic research relevant to the design and development of instrumental concepts for future x-ray and gamma-ray astronomy missions and the conduct of scientific investigations in the energy range from 0.1 keV to 100 GeV via exposure of instrumentation carried on sounding rockets and high-altitude balloons. The primary goal of this program is to obtain a better understanding of astrophysical objects (excluding the Sun) and phenomena as revealed through their high energy radiation characteristics. In the context of this solicitation, X-rays are defined as photons in the approximate energy range 0.1-30 keV, while gamma-rays are considered to lie in the energy range 30 keV-100 GeV. Proposed research projects may include ground-based observations of phenomena defined primarily by their high-energy characteristics, provided that such studies pertain directly to NASA's X-Ray and Gamma-Ray Astrophysics flight programs. Note that while the scientific and technical merit of the proposed research is the primary evaluation criterion, relevance to the goals of NASA's X-Ray and Gamma-Ray Astrophysics programs is of nearly equal weight and must be explicitly described in the proposal. A list of relevant X-Ray and Gamma-Ray missions is provided in Tables I and II below in this Section, which are furnished only as a guide to assessing relevance of proposals for this program element.

Note: Laboratory astrophysics investigations relevant to X-Ray and Gamma-Ray astrophysics are no longer included within this Program Element; such investigations are now solicited under the Program Element entitled Space Astrophysics Research and Analysis (SARA) Program (see A.7). Theoretical investigations that are generally relevant to this science area are also solicited separately under the Astrophysical Theory Program (Section A.1.5 of this Appendix), and projects directed mainly toward the analysis of archival data are covered under the Astrophysics Data Program (Section A.1.3). Investigations that fall into any of these categories are not within the scope of the HEA Cluster Program Element.

Specific guidance for the preparation and submission of proposals for this program component is given in Sections 8.3, 8.4, and 8.5. The due dates for Notices of Intent to propose and for delivery of the hard copies of the proposals is given in Table I of the summary cover letter to this NRA.

Table I - NASA Gamma-ray Astronomy Missions Relevant to this Program Element

MISSION	PRIMARY EMPHASIS
Compton Gamma-Ray Observatory (CGRO)	All-sky wide-band gamma-ray survey
Global Geospace Program (GGS [Wind/TGRS/Konus])	Gamma-ray burst spectroscopy
High-Energy Transient Experiment* (HETE-II)	Gamma-ray burst position determination
INTEGRAL*	High-resolution gamma-ray spectroscopy
GLAST	High-throughput, high energy gamma-ray imaging/spectroscopic observations of selected cosmic gamma-ray sources
Swift	Gamma-ray burst position determination
High-Resolution Spectral Imager (HSI)	High-resolution spectroscopy & imaging in hard X-rays (1-200 keV)
Energetic X-Ray Imaging Survey Telescope (EXIST)	Hard X-ray all-sky survey (10-500 keV)
Advanced Compton Telescope (ACT)	High-throughput Compton telescope (0.5-30 MeV)

* International Collaboration

Table II - NASA X-ray Astronomy Missions Relevant to this Program Element

MISSION	PRIMARY EMPHASIS
ASCA*	Spatially-resolved spectroscopic observations of selected cosmic x-ray sources
X-ray Timing Explorer (XTE)	Spectrophotometric observations of selected cosmic x-ray sources
Chandra X-ray Observatory (CXO)	High-resolution imaging/spectroscopic observations of selected cosmic x-ray sources
Spectrum-X-Gamma*	High-throughput, moderate-resolution imaging spectroscopic and polarimetric observations of selected cosmic x-ray sources
X-ray Multi-Mirror Mission* (XMM)	High-throughput, moderate-resolution imaging/spectroscopic observations of selected cosmic x-ray sources
ASTRO-E*	Spatially-resolved high-resolution spectroscopic observations of selected cosmic x-ray sources
Constellation X	High-throughput, high-resolution spectroscopic observations of selected cosmic x-ray sources
MAXIM	Ultra-high resolution x-ray imaging

* International Collaboration

A.8.2 Cosmic Ray Astrophysics

The Cosmic-Ray Astrophysics program supports studies of the origin, acceleration, and transport of galactic cosmic rays. Fundamental measurements include the elemental abundance, isotopic composition, and energy spectra of galactic cosmic rays, as well as antimatter, exotic particles, and dark matter to provide tests of cosmological models. This experimental program primarily supports science investigations utilizing large stratospheric balloons to carry instruments above about 99% of the Earth's atmosphere. The balloon payloads funded over the past decade have been similar in many respects (e.g., level of technological sophistication, management approach, etc.) to space flight instruments for a focused science investigation. **Note: Theoretical investigations that are generally relevant to this science area are now solicited under the Astrophysical Theory Program (Appendix A.1.5).** It should also be noted that this program does not support ground-based observations. It may, however, support exploration and demonstration of new space-based instrument concepts pertinent to the science goals of the discipline.

The Cosmic-Ray Astrophysics Program underwent a comprehensive review in response to the ROSS 1998 solicitation. The selections from that review resulted in a balanced experimental research program that was expected to last for three years, i.e., through FY 2001. However, as a result of the merging of this discipline into the High Energy Astrophysics (HEA) Cluster, approximately one-quarter of the annual cosmic-ray astrophysics budget will be available for competition through the HEA Cluster in this ROSS 2000 NRA. The ongoing cosmic-ray projects selected via the ROSS 1998 NRA that must recompete in response to this ROSS 2000 NRA solicitation have been explicitly notified: if you have not been so notified, you may not repropose your ongoing project in response to this NRA.

All projects selected for this discipline must demonstrate high scientific merit and a credible plan for project completion. The latter must include a viable schedule, cost plan, management plan, and the anticipated balloon flight requirements to carry out the project, new or ongoing. The current fiscal climate and budget pressures demand that the total life-cycle costs of all flight projects be known, including the costs through publication of the results, even if those publications may not occur with the nominal three-year award. A very limited number of 5-year awards may be permitted to develop a completely new, highly meritorious mission through its first flight(s). The annual funding needs, the total project cost, the performance on recent, prior investigations (if applicable), and the extent to which an investigation contributes to the U.S. technological capability will be major factors in continuing ongoing projects and in selecting new investigations. All multiyear awards are contingent upon detailed progress reports and interim reviews that indicate sufficient progress was made in the previous year to warrant continued funding. The total out-year commitments, even though they are only tentative, must still allow for a stimulating future program of new investigations within the overall budget constraints. Based on past experience, we expect to select at most one new, major balloon mission every three years as an old mission is completed and terminated

Specific guidance for the preparation and submission of proposals for this program component is given in Sections 8.3, 8.4, and 8.5. The due dates for Notices of Intent to propose and for delivery of the hard copies of the proposals is given in Table I of the summary cover letter to this NRA.

A.8.3 Programmatic Considerations

It is anticipated that roughly \$3M will be available from X-Ray and Gamma-Ray Astrophysics and Cosmic-Ray Astrophysics SR&T funds through this NRA for funding new three-year projects, with increased funding applicable in succeeding years. The schedule (due dates for Notices of Intent to propose and the proposals themselves) is provided in Table 1 of the cover letter of this NRA.

Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.2 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

Note, however, that because of the greater degree of complexity of experimental project proposals for the HEA Cluster, the Science/Technical/Management section of such proposals may be 25 pages long, instead of the default 15 pages specified in Section C.5.2.

The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is TBD*. Hard copies of the proposals are to be delivered to:

ROSS-2000 NASA Research Announcement

High Energy Astrophysics Cluster

TBD*

*TBD: see SPECIAL NOTE (3) in the summary cover letter of this NRA.

A.8.4 Multi Institutional Proposals

Proposals for development of a sophisticated balloon payload for a focused scientific investigation frequently involves collaborations among several institutions. Such proposals should be in the form of individual investigation proposals, which may include Co-I's from the PI's home institution and/or from other institutions. Since the evaluation of each proposal is based upon the scientific merit of the investigation, it is important that all the information required to perform that evaluation be concentrated in one place, without extraneous material relating to other investigations in which the PI or any Co-I's may be participating. There are two possible institutional arrangements:

11. If all Co-I's in an investigation are from the same institution as the PI, only a single (25 page) proposal is to be submitted (see Appendix C.5). In this case, the role of each Co-I must be fully defined and the investigation budget must include any budgets for those Co-I's.
12. For multi institution investigations, *i.e.*, those with Co-I's from institutions other than that of the PI, each such institution must:
 - (a) submit a task statement, not to exceed five pages, as an Appendix to the PI's proposal describing the contribution of that institution to the investigation, the roles of the Co-I(s) (if more than one, define a single Lead Co-I for that institution), and a summary budget for the task; and,
 - (b) submit the same five-page task statement and budget as a separate proposal (with all the required forms and documentation) directly to NASA from that institution as authorized by an appropriate institutional representative, including a clear cross-reference to the PI's proposal (see Appendix C.5.3); the Lead Co-I from that institution should serve as the "Institutional PI" for the proposed task.

Regardless of the institutional affiliation of any Co-I's, the only proposal that will be reviewed is that from the PI, which must include the 5-page appendices, not included in the 25-page count, for all Co-I institutions, if any, other than that of the PI. Therefore, Co-I tasks will not be considered for funding independently of the overall investigation submitted by the relevant PI. Conversely, NASA reserves the right to select all, some, or none of the Co-I's that may be proposed as part of an investigation. Cases involving partial or non selections of Co-I's will be negotiated with the PI before a final decision is reached.

If such a multi institutional investigation is selected for funding, separate awards will generally be made to each institution involved in the investigation, with a Lead Co-I from each non-PI institution serving as the "Institutional PI" for the award to that Co-I institution. Alternatively, at the request of the PI and with the concurrence of the Lead Co-I from a separate institution, a subcontracting arrangement between the PI institution and that Co-I institution may be proposed.

A.8.5. General Information.

Additional information about the X-Ray and Gamma-Ray Astrophysics program may be obtained from the Discipline Scientist:

Dr. Louis J. Kaluzienski
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: 202-358-0365
E-mail: louis.kaluzienski@hq.nasa.gov

Questions concerning the Cosmic-Ray Astrophysics program should be addressed to:

Dr. W. Vernon Jones
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: 202-358-0885
Fax: 202-358-3097
E-mail: w.vernon.jones@hq.nasa.gov

A.9 INTERDISCIPLINARY PROGRAM ELEMENTS

A.9.1 Applied Information Systems Research

NOTE: This is a preliminary description for this component of this NRA. A final version will be posted as an Amendment to this solicitation no later than 90 days prior to the due date for proposals as indicated in Table 1 of the Cover Letter to this NRA. Until April 15, 2000, comments or suggestions on this version are welcome and may be directed to the Discipline Scientist named below in Section 3.

1. Scope of Program

The Applied Information Systems Research (AISR) program conducts advanced information systems research to apply new developments in computer science and information technology to improve and enhance ongoing support for OSS science programs. The specific goals of the AISR program are to:

- Increase the scientific return on research within all OSS science themes by making advanced tools and capabilities available for the acquisition and utilization of science data and information;
- Exploit advances in computer science and information technology for the benefit of space science; and
- Promote strong collaborations involving the space science community, computer science community, data system engineers and technologists, academia, and the private sector and technology innovators.

OSS seeks proposals through this program to apply state-of-the-art computer science and information technology to improve the understanding and effectiveness of OSS scientific research endeavors. The period of performance for solicited proposals may be from one to three years. Background information on the AISRP and abstracts for current investigations being conducted can be found on line at <http://spacescience.nasa.gov/computer/aisr>.

2. Areas of Interest

OSS seeks innovative applications of information technology across a broad range of scientific areas, including:

- Science data analysis and visualization;
- Simulations, computational methods, and modeling in support of extracting science from NASA data sets;
- Science mining and exploration, including software technology, adaptive techniques, data compression, etc.
- Science planning and operations, including innovative concepts and ideas beyond current methods and processes for spacecraft/science operations;;
- Science data management, storage, and distribution; and
- Science data product generation for the benefit of a broader community of scientists.

Proposers are encouraged to propose original, innovative applications of information technology that will be more broadly applicable across multiple science disciplines and/or projects. This program allows for and encourages risk-taking in terms of pushing the state-of-the-art in information systems technology as mitigated by the potential payoff if successful. Priority consideration will be given to proposals that foster and facilitate interdisciplinary research or that contribute to more interoperable high performance information technology frameworks for conducting space science research.

3. Guidelines for Proposals

Proposals are expected to present a clear and concise description of:

- Specific objectives for the investigation, products to be developed, and a work plan for accomplishing the proposed tasks; and
- Compelling justification for the endeavor and how it extends the forefront of computer science and technology , as well as its relevance and importance for space science research.

Note that the AISR program is intended to provide tools needed to conduct the space science research disciplines and not for that research itself. So there is not an emphasis on a project having a particular science goal, but the proposal should clearly demonstrate how it supports the needs of science community. Prospective submitters should also be aware that considerable tools and capabilities have been provided by previously selected participants in this program, as well as through other sources. Proposals should demonstrate how the proposed effort clearly extends the frontiers of capabilities in a fundamental and important manner rather than repeating or maintaining current capabilities. If a proposal is itself based on a previously funded effort, the proposal should identify that work, clearly summarize significant results from it, and demonstrate how the current effort is unique and/or extends the capability.

All resulting products developed under this program will be made openly available to the community at the end of the award period, including original source code. Adequate documentation must accompany the product to allow use by the general community, which includes complete description of application, explanations of algorithms, user instructions, demonstration examples, etc. Proposals must clearly describe how they plan to assure the quality of such final products.

It is expected that successful products and capabilities resulting from this program will be registered in and made available through the Space Science Data Services (SSDS) infrastructure. Information on current resources, services, and data centers is on line at <http://ssds.nasa.gov/>

4. Programmatic Information

Total funding for the existing AISRP is nominally \$6M per year. Of the nearly 50 investigations currently funded, approximately 3% will expire in FY 2001, thereby freeing up a similar percentage of funds for competition through this NRA.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.2 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and for proposals is given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the *Cover Page/Proposal Summary* (see Appendix C.5) is TBD*. Hard copies of the proposals are to be delivered to:

ROSS-2000 NRA
Applied Information Systems Research Program
TBD*

*TBD: see SPECIAL NOTE (3) in the summary cover letter to this NRA.

For further information, contact the Discipline Scientist for this program element:

Mr. Joseph H. Bredekamp
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-2348
E-mail: joe.bredekamp@hq.nasa.gov

A.10 EDUCATION/PUBLIC OUTREACH (E/PO) PROGRAM

A.10.1 Scope of Program

The Office of Space Science (OSS) has developed a comprehensive approach for making education at all levels (with a particular emphasis on K-14 education) and the enhancement of public understanding of space science integral parts of all of its research missions and programs. To this end, OSS invites and encourages all proposers to this NRA to include an Education and Public Outreach (E/PO) component in their research proposals. In addition, anyone holding an existing multiple year research award already funded through any previous OSS NRA is encouraged to propose an E/PO supplement to their award (see details below). The two key documents that establish the basic policies and guidance for all OSS E/PO activities are a strategic plan, entitled *Partners in Education: A Strategy for Integrating Education and Public Outreach Into NASA's Space Science Programs* (March 1995), and an implementation plan, entitled *Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy* (October 1996). Both of these documents may be obtained by selecting *Education and Public Outreach* from the OSS homepage at <http://spacescience.nasa.gov>, or from Dr. Jeffrey Rosendhal, Office of Space Science, Code S, NASA Headquarters, Washington, DC 20546-0001.

The following policies and guidelines apply to the E/PO activities solicited through this NRA:

- The proposed E/PO activity is expected to have general intellectual linkage to the science objectives of its “parent” proposal and/or the science expertise of its PI;
- An E/PO activity may be funded only as an add-on to a new or an existing award for a “parent” research proposal; therefore, the period of performance of the E/PO activity is restricted to that of its parent award;
- Up to \$10K per year may be proposed for an E/PO program, although larger budgets may be considered for a few exceptionally meritorious activities (Note: a Budget Summary must be submitted as part of an E/PO proposal as described further below);
- NASA requests (but does not require) that the submitting organization waive PI labor costs and its customary overhead charges on an E/PO budget, since in many cases such activities will directly aid a local educational or public science institution, and the budget available for this OSS E/PO program is extremely limited;

5. The parent research proposal may identify an additional Co-Investigator who, along with the PI of the parent research proposal, will be responsible for completing the E/PO activities (e.g., an appropriately qualified colleague from the PI institution, or from an educational institution such as a public school district, science museum, planetarium, etc.);
 - E/PO proposals will be evaluated (see criteria below) by appropriately qualified scientific, education, and outreach personnel, and the substance of these reviews will be conveyed to the proposers in a summary report; and
1. The OSS Selecting Official will take into account proposed E/PO tasks and their review ratings when deciding on final selections and funding levels and as an aid in discriminating between highly qualified research proposals having otherwise comparable merits.

A.10.2 Evaluation Criteria

IMPORTANT NEW INFORMATION

OSS has developed a document, entitled *Explanatory Guide to the NASA Office of Space Science Education and Public Outreach Evaluation Criteria*, as a resource for proposers who want to submit an E/PO proposal in conjunction with their research proposal. This *Explanatory Guide* may be accessed through the OSS homepage Web site indicated above or directly at <http://spacescience.nasa.gov/education/guide.html> ; navigation through this *Explanatory Guide* at its Web site is facilitated by internal active links. This *Guide* is not an extension of the E/PO requirements or criteria but is meant to provide an easy-to-follow introduction to this program using a series of Frequently Asked Questions (FAQ), followed by a detailed discussion of the E/PO review criteria given below. All proposers who are considering the submission of an E/PO proposal but who are not familiar with the specific OSS standards for E/PO activities are urged to review this *Explanatory Guide*.

Based on the OSS E/PO strategy and implementation plans noted above, there are two classes of evaluation criteria against which proposed E/PO activities will be evaluated. Although creativity and innovation are certainly encouraged, note that neither of these sets of criteria concerns the originality of the proposed effort. Instead, NASA seeks assurance that the proposer is personally committed to the E/PO effort and that the PI of the parent proposal and/or appropriate research team members will be actively involved in carrying out a meaningful, effective, credible, and appropriate E/PO activity; that such an activity has been planned and will be executed; and that the proposed investment of resources will make a significant contribution towards meeting stated OSS plans and objectives (interested proposers to this E/PO program are urged to consult the *Explanatory Guide* referenced above).

General Criteria

The following general criteria will be applied to the evaluation of all proposals and reflect requirements necessary for further consideration by NASA OSS of an E/PO proposal:

- The quality, scope, and realism of the proposed E/PO program including the adequacy, appropriateness, and realism of the proposed budget;
- The capabilities and commitment of the proposer and the proposer's team to carry out the proposed E/PO program, including the direct involvement of one or more science team members in overseeing and carrying out the proposed E/PO program (Note: this criterion is intended to preclude proposals that serve only to "pass through" money to an external organization or individual who would carry out the proposed E/PO activity, since such a case is inconsistent with the intention of OSS that the research community be actively involved in education and public outreach);
- The establishment or continuation of effective partnerships with institutions and/or personnel in the fields of educational and/or public outreach as the basis for and an integral element of the proposed E/PO program; and
- The appropriateness of plans for evaluating the effectiveness and impact of the proposed education/outreach activity.

Specific Criteria

To ensure that the goals and objectives of the OSS E/PO strategy are realized in practice, E/PO proposals will also be evaluated using at least one of the following specific criteria, as appropriate, for the submitted proposal. Because of the modest financial scope of this program, not all E/PO proposals can (or even should) address all of these specific factors; a sound, well-posed, and focused effort that will clearly be effective in reaching its intended target audience is preferable to an unrealistically broad effort. These specific criteria are:

- For proposals dealing directly with or strongly affecting the formal education system (e.g., teacher workshops or student programs carried out at public institutions such as science museums and planetariums), the degree to which the proposed E/PO effort is aligned with and linked to nationally recognized and endorsed education reform efforts and/or reform efforts at the state or local levels;
- The degree to which the proposed E/PO effort contributes to the training, involvement, and broad understanding of science and technology by underserved and/or underutilized groups; and/or

- The potential for the proposed E/PO activity to expand its scope by having an impact beyond the direct beneficiaries (e.g., reaching relatively large audiences, being suitable for replication or broad dissemination, and/or drawing on resources beyond those directly requested in the proposal).

A.10.3 Options for E/PO Proposals

OSS expects that most E/PO proposals will be submitted by a single proposer as a supplement to a single science proposal submitted to one of the program components in this NRA. However, NASA OSS will allow two special options to this baseline pattern as discussed below (Note: as a departure from previous OSS NRA's, the so-called "Institutional" E/PO proposal option is no longer offered).

A.10.3.1 Submission of the Same E/PO Proposal with Multiple Research Proposals Submitted by the Same Proposer

OSS recognizes that a single proposer may submit more than one research proposal to different research components as defined in this NRA (see the summary cover letter and Appendix A). In such a case, that one proposer may submit the same E/PO proposal with all his/her research proposals subject to the three conditions that: (i) OSS will review such an E/PO proposal only the first time it is submitted; (ii) this one evaluation will carry through to all other submissions of that same E/PO proposal for this NRA as well as all other OSS NRA's to be issued in CY 2000; and (iii) such an E/PO proposal will be funded only once (i.e., NASA will not fund the same activity more than once even though it may be enhanced by such an increase in support). The Web page to be used for the submission of an E/PO proposal (see further below) will request information regarding the first submission and any subsequent submissions of this proposal to this NRA. Note that in such a case, the E/PO proposal must be resubmitted in the identical form as it was the first time; OSS does not have the resources to separately evaluate E/PO proposals that have only minor changes between such multiple submissions. Of course, multiple but substantially different E/PO proposals submitted by the same proposer will receive individual evaluations.

A.10.3.2 Submission of an E/PO Proposal as a Supplement to an Existing Multiple Year OSS NRA Award

In addition to PI's selected through this NRA, OSS also wants to encourage holders of existing awards to become involved in E/PO activities. Therefore, any PI of an existing multiple year award selected through any OSS NRA (including this one) having at least one year remaining in the award's period of performance may submit an E/PO proposal as a supplement to that "parent" research award. The period of performance for such a supplemental E/PO activity is limited to that of the parent research award. Such a

supplemental E/PO proposal must be prepared and submitted as a stand-alone proposal following the format and guidelines given below in Section 10.5.

The deadline for the submission of such an E/PO supplemental proposal is the same month and day as the NRA through which the parent proposal was selected (if there are any questions, contact the relevant Discipline Scientist for that program component). Such supplement proposals will be reviewed using the criteria given above, and, if accepted, the E/PO funding will start on the anniversary date of the parent award.

A.10.4 Assistance for the Preparation of E/PO Proposals

To help interested proposers in developing a effective E/PO proposals, NASA OSS has established a nationwide infrastructure of space science education/outreach groups to directly aid space science investigators in identifying and developing high quality E/PO opportunities. This infrastructure provides the coordination, background, and linkages for fostering partnerships between the space science and E/PO communities, and the services needed to establish and maintain a vital national, coordinated, long-term OSS E/PO program. The two elements of this system of particular interest to researchers interested in submitting E/PO proposals are:

- Four OSS science theme-oriented "E/PO Forums" that aid OSS in organizing the comprehensive education/outreach aspects of OSS space science missions and research programs, and provide both the space science and education communities with ready access to relevant E/PO programs and products; and
- Five regional "E/PO Broker/Facilitators" that search out and establish high leverage opportunities, arrange alliances between educators and OSS-supported scientists, and help scientists turn results from space science missions and programs into educationally-appropriate activities suitable for regional and/or national dissemination.

Prospective proposers are strongly encouraged to make use of these groups to help identify suitable E/PO opportunities and arrange appropriate partnerships and alliances but should note that the responsibility for actually developing the E/PO program and writing the proposal is that of the proposer. Points of contact and addresses for all of these E/PO Forums and Broker/Facilitators are found by opening *Education and Public Outreach* from the menu of the OSS homepage at <http://spacescience.nasa.gov> .

A.10.5 Preparation and Submission of an E/PO Proposal

To aid interested proposers in composing and submitting a complete E/PO proposal, NASA OSS has established a comprehensive electronic form that is accessed through menu on the Web site <http://www.lpi.usra.edu/panel/> . Completion of all the fields of this electronic form with the requested information and text is necessary before a proposal may be submitted for evaluation (Note: only electronically submitted E/PO proposals will be evaluated). This site may be accessed at any time up to the due date for each of the proposals as given in the cover letter of this NRA, and by using a unique identification

number that will be provided at the time of first access, all fields may be edited up to final submission. The requested information may be transferred from any standard word processing software, although only text may be used to complete these fields on this Web site; i.e., this site will not accept illustrations or drawings. As an aid in developing the required information for the final electronic submission, this E/PO format may also be printed at any time.

This Web submission also requires a summary of the E/PO budget (both total and by year) using the same format shown for the research Budget Summary form shown in Appendix C.6 in this NRA. As a change from previous practice for E/PO proposals, it is no longer necessary to integrate the E/PO budget with that of its parent research proposal; however, for new proposals it is still necessary to state the summary E/PO budget (in total and by year) on the proposal *Cover Sheet* (see Section C.5.2).

Once it is submitted, the completed E/PO proposal (including all Budget Summary sheets) can then be printed out from the Web site by the proposer to provide the appropriate hard copy for submission either with their parent research proposal, or as a separate supplemental proposal if it is being submitted as an addition to an existing award (see above).

A.10.6. Reporting Activities for Approved E/PO Proposals

In order to assist OSS in obtaining a coherent picture of the entire portfolio of E/PO efforts supported across all OSS programs a brief report of selected E/PO activities are to be provided as part of the annual Progress Reports required for the parent research award (Note: it is expected that all such Progress Reports for the proposals selected through this NRA will be submitted electronically through a to-be-designated Web site). In addition, one of the OSS Education Forums (see above) will contact the PI's of selected E/PO components to obtain basic summary information concerning the nature of and intended audience for their selected E/PO effort.

A.10.7 Additional Information

General questions about this E/PO program may be directed to:

Dr. J. David Bohlin
Research Program Management Division
Code SR
Office of Space Science
National Aeronautics and Space Administration
Washington DC 20546-0001
Telephone: (202) 358-0880
E-mail: david.bohlin@hq.nasa.gov

Finally, attention is also called to the Initiative to Develop Education through Astronomy and Space Science (IDEAS) program administered by the Space Telescope Science Institute (STScI) on behalf of OSS. The IDEAS program is open to any space scientist based in the U.S. regardless of whether or not they hold a research grant from NASA OSS. This program, which selects proposals yearly, provides awards of up to \$40K to foster the development of innovative approaches to space science education and outreach by space scientists and their educator partners. The annual solicitation for the IDEAS program is typically released in July with proposals due in October. The annual request for proposals is posted at. Inquiries may be addressed by E-mail to IDEAS@stsci.edu or by postal mail to: IDEAS Program, Office of Public Outreach, Space Telescope Science Institute, 3700 San Martin Drive, Baltimore MD 21218.